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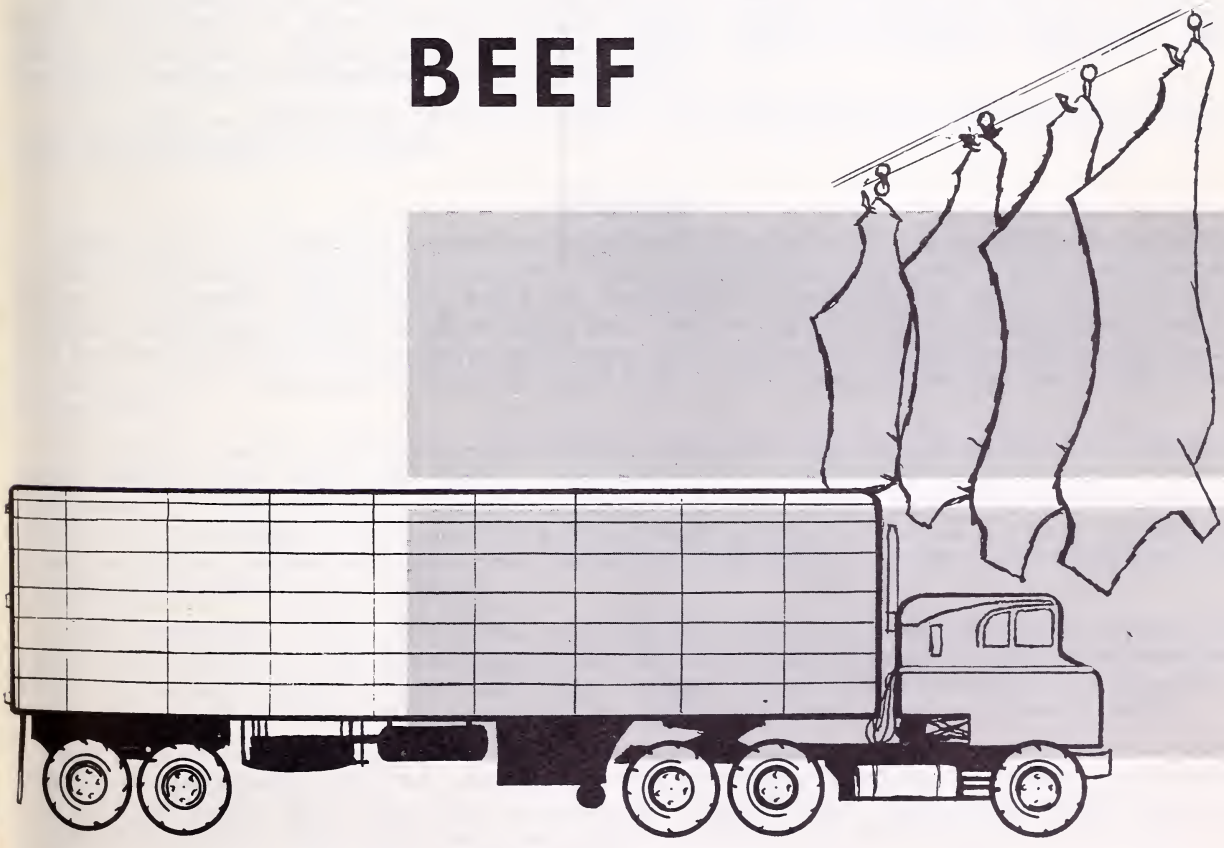
Motortruck Transportation of Freshly Killed BEEF



Marketing Research Report No. 119

UNITED STATES DEPARTMENT OF AGRICULTURE Agricultural Marketing Service

June 1956

Slightly revised September 1956

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The study on which this report is based was conducted under authority of the Agricultural Marketing Act of 1946.

SUMMARY

This report is based on a series of studies to determine the most efficient method of protecting freshly killed beef of canner and cutter grade in transit. Twelve motortruck trailers, equipped with various types of mechanical refrigerating units, were tested to compare different methods of circulating the cold air from the refrigerating units around and through the load. Comparisons also were made of meat-hanging rails of two designs, (1) heavy wood crossbeams and (2) lightweight metal rails extending the length of the trailer body.

In trailers with crossbeam meat rails, relatively high temperatures were found in meat loaded near the rear doors. Apparently the effect of these rails was to create turbulence or back pressure which interfered with the movement of cold air to this part of the load. Circulation was improved substantially by using a canvas air duct, suspended from the trailer ceiling and above the meat rails, effecting a cold air movement over the crossbeams toward the rear doors.

The longitudinal lightweight metal rails did not obstruct the passage of air toward the rear of the trailer to any great degree, and generally satisfactory product temperatures were maintained throughout the load. The weight saving was substantial; the aluminum rails weighed about 235 pounds compared to 1,560 pounds for wood crossbeam rails.

Mechanical refrigerating units of 5-ton capacity were ample to lower the in-transit product temperatures when the right equipment and proper methods of loading were used, but on tight loads there was some evidence of "smothering" (damage to meat from lack of air circulation). Test data were not sufficient to indicate the relative performance of 2-ton units in comparison with those of 5-ton capacity.

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MOTORTRUCK TRANSPORTATION OF FRESHLY KILLED BEEF

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Transportation and Facilities Branch
Agricultural Marketing Service

Rapid expansion in the movement of freshly killed beef by refrigerated motortruck over increasingly greater distances has brought problems in protecting the quality of the commodity in transit.

A serious problem in transporting freshly killed beef from the Texas area results from a frequent necessity for reducing the product temperature while the meat is in transit. The meat packer ships the product the day after killing, because the output of packing plants during the rush seasons often is greater than their storage and cooling capacity. The motor carrier therefore must use insulated trailers with mechanical refrigerating units of greater capacity than would ordinarily be required if the product were precooled in the packing plant. Also, the construction of the trailer and the way the meat is loaded must not interfere with refrigeration efficiency.

EQUIPMENT STUDIED

The 12 refrigerated truck trailers used in this series of transportation-refrigeration tests were 32-foot heavy-duty tandem-axle units. They had aluminum outside sheathing and corrugated aluminum interiors, with 6 inches of glass fiber insulation in the walls, ceiling, and floors. All of the trailers had 1- by 3-inch side-wall wooden strips spaced 15 inches apart, extending the inside length of the body. Heavy paper was tacked to these strips, preventing the hanging meat from becoming discolored by rubbing against the aluminum side walls.

Two types of meat rails were used: (1) Heavy oak 2- by 6-inch crossbeams (fig. 1), extending from wall to wall and spaced 12 inches apart; and (2) aluminum pipes 2 inches in diameter, hung from the ceiling lengthwise of the body of the trailer, spaced approximately 10 inches apart (fig. 2). In all of the trailers with either type of meat rail, a space of 4 inches remained between the top of the meat rail and the ceiling for circulation of air blown from the mechanical refrigerating units.

Two test trailers, with either partial or full loads of meat on the floor, were equipped with temporary wooden floor racks covered with heavy paper. These racks held the load 2 inches above the trailer floor (figs. 3 and 4). Floor racks were not used with the loads of hanging beef.

Mechanical refrigerating units with rated refrigeration capacities of 2 tons and 5 tons were used in the tests. In some trailers the equipment was installed high in the nose of the trailer, with the gasoline engine, compressor, and their accessories on the outside, and the evaporator coil and air-circulating fans within the loading space (fig. 1). The units were fully automatic, the engine starting on the demand of the thermostat and stopping when the desired interior temperature was reached. The truck driver operated a manual switch to defrost the evaporator coil.

In other installations, the refrigerating unit was mounted under the trailer. This unit also was fully automatic, and its engine, compressor, generator, and condenser were combined into one assembly (fig. 3). The evaporator coil and air-circulating fans were mounted on the forward wall inside the trailer. Once this unit was started, the engine operated continuously throughout the trip, and the refrigeration was controlled by the

automatic modulation of the engine speed according to the temperature desired. For example, the unit operated at high speed (1,900 RPM) until the desired temperature was reached, then the thermostat reduced the speed of the engine to low (1,100 RPM), at which it operated until the control bulb demanded more refrigeration. Defrosting of the evaporator coil was accomplished through a manually operated switch.

In 3 of the tests where crossbeams were used as meat rails, a canvas sheet 5 feet wide and 20 feet long was fastened over the crossbeams and to the sides of the truck to form an air delivery channel. The canvas was suspended by ceiling hooks, approximately 1 inch from the ceiling (fig. 5). This was an experiment to see whether the arrangement would aid the delivery of cold air over the meat rails to the rear of the trailer.

TEST PROCEDURE

Commodity and air temperatures were obtained by means of electrical-resistance thermometer bulbs inserted directly into the beef carcasses. Each bulb had a 2-wire lead that connected to a master cable, suspended from the trailer ceiling. When the trailer doors were closed, a tight air seal was maintained, since a short section of the cable at the door consisted of a sponge-rubber strip about $\frac{1}{2}$ inch thick and 2 inches wide. The end of the cable was equipped with a multiple-contact plug fitted into a temperature reading instrument. Temperatures for each position were obtained by a selector switch on the reading instrument, making it unnecessary to enter the truck trailers or disturb the loads. Temperatures were recorded at intervals of approximately 4 to 6 hours by representatives of the U.S. Department of Agriculture, who accompanied the shipments from origin to destination.

The positions of the electrical-resistance thermometers in the loads and their designations were as follows (fig. 1):

Location	Designation
Top door centerline, air	TDCL, air
Bottom bunker centerline, air	BBCL, air
Bottom door centerline, air	BDCL, air
Top bunker centerline, commodity	TBCL
Top half centerline, commodity	THCL
Top door centerline, commodity	TDCL
Middle half right side, commodity	MHRS
Bottom bunker centerline, commodity	BBCL
Bottom bunker right side, commodity	BBRS
Bottom half centerline, commodity	BHCL
Bottom half right side, commodity	BHRS
Bottom door centerline, commodity	BDCL

Precooling and Loading

The truck trailers generally were precooled for short periods prior to loading, by operating the refrigerating units while en route from the truck terminals to the packinghouses. The fresh beef carcasses or sides of beef usually were chilled before being loaded into the refrigerated truck trailers. The quarters were hung on meat hooks from the meat rails. When loading a truck trailer with hanging beef, the general practice was to alternate several rows of hindquarters with several rows of forequarters, until loading was completed. The forequarters were hung on long hooks inserted from the bone side under the fourth rib so that they would balance and hang straight. The short hooks were used in hanging the hindquarters. These were inserted through the opening in the gambrel cord of the shank. Both the forequarters and the hindquarters were hung from the side walls to the center of the load, taking up any sidewise slack (fig. 4). In some instances, 2 or 3 smaller quarters were nested together on one hook (fig. 1). In one test, the beef carcasses were loaded on the floor of the trailer (fig. 3). This method of loading is not generally used on long hauls.

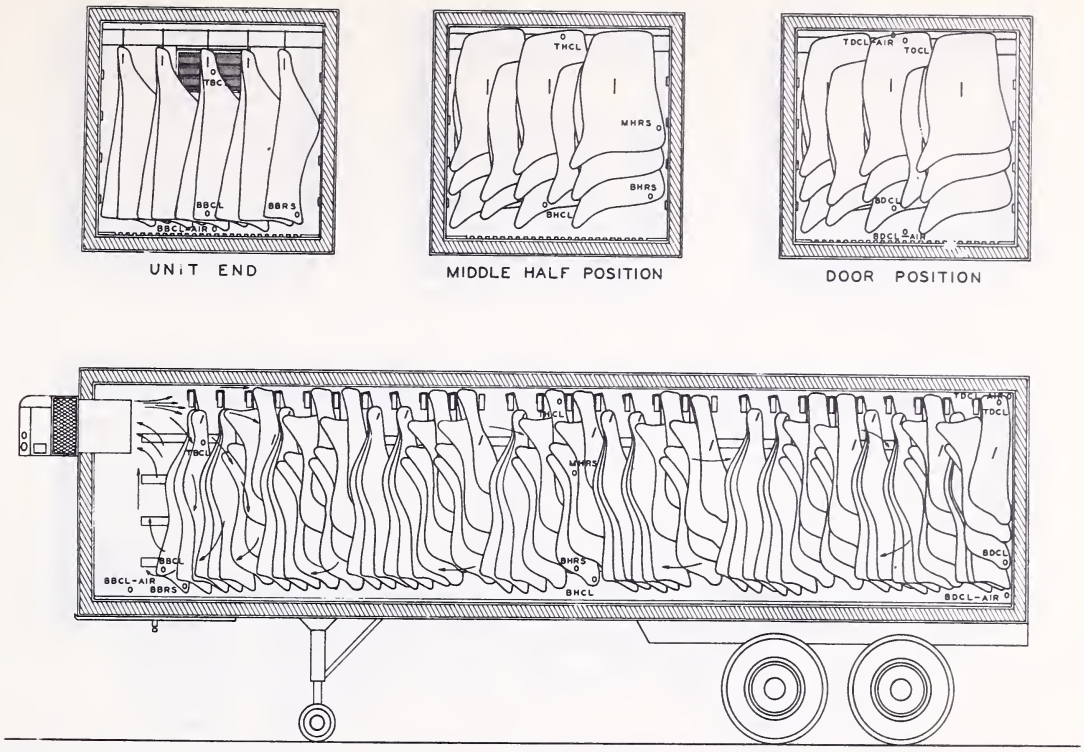


Figure 1.--A diagram showing beef quarters suspended from heavy oak crossbeams in a trailer equipped with a mechanical refrigerating system. The locations of the electrical resistance thermometers are also shown. For explanation of TBCL, THCL, etc., see page 2.

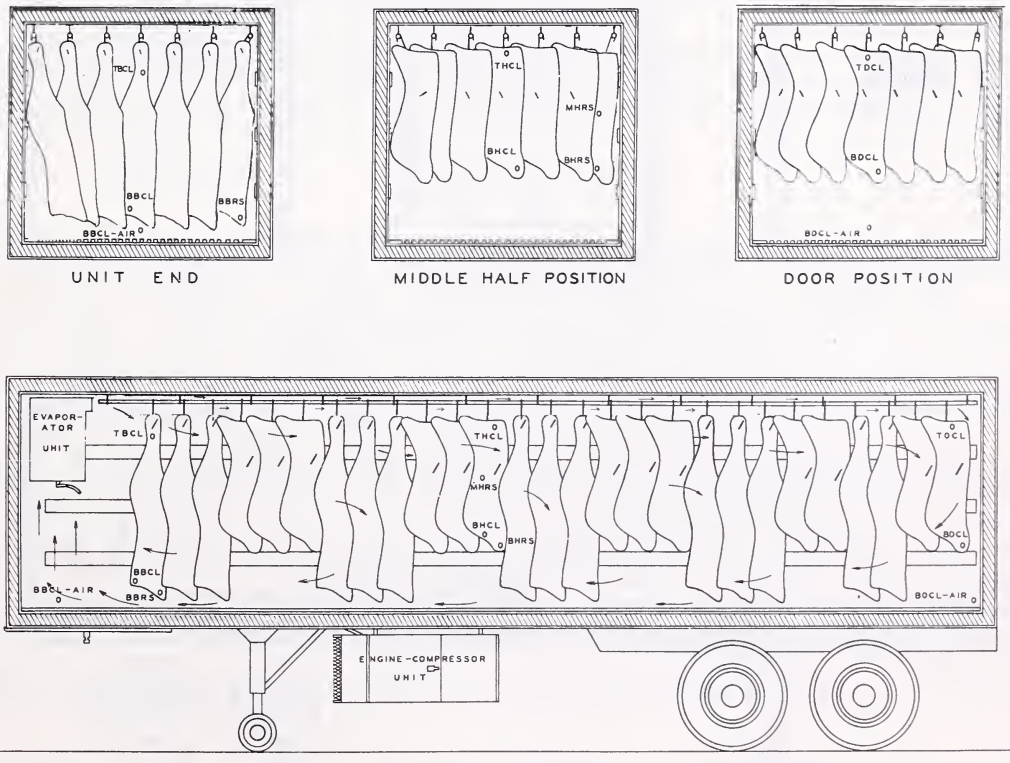


Figure 2.--A diagram showing the beef quarters suspended from the longitudinal light weight metal meat rails in a trailer equipped with a mechanical refrigerating system. The locations of the electrical resistance thermometers are also shown. For explanation of TBCL, THCL, etc., see page 2.

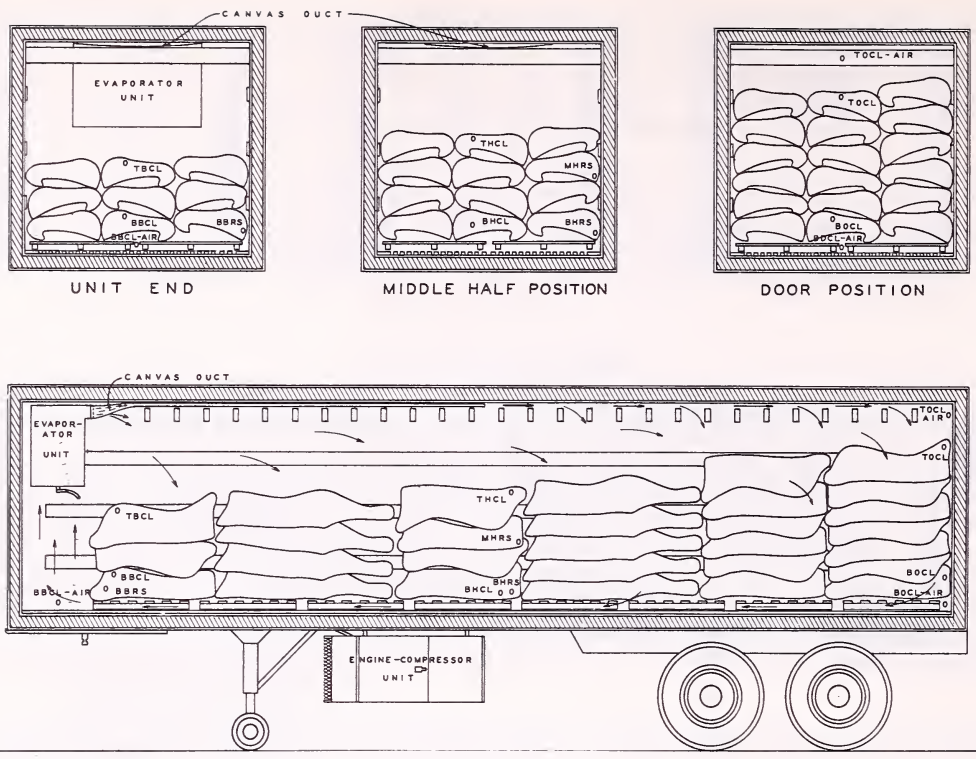
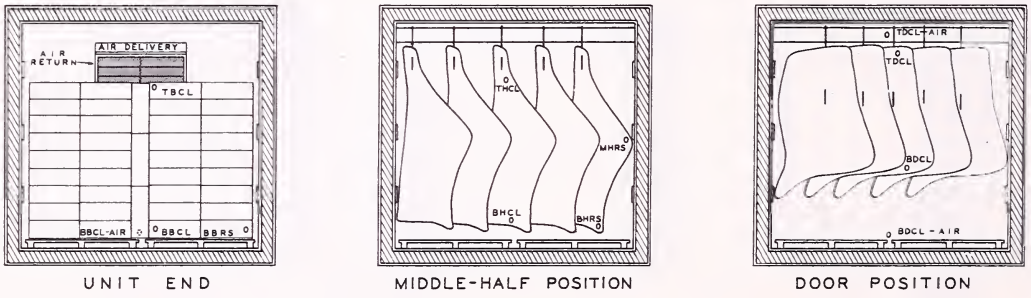


Figure 3.--A diagram showing beef quarters loaded on the floor. Also illustrated are the sidewall strips, floor racks, canvas air duct, and locations of electrical resistance thermometers. For explanation of TBCL, THCL, etc., see page 2.



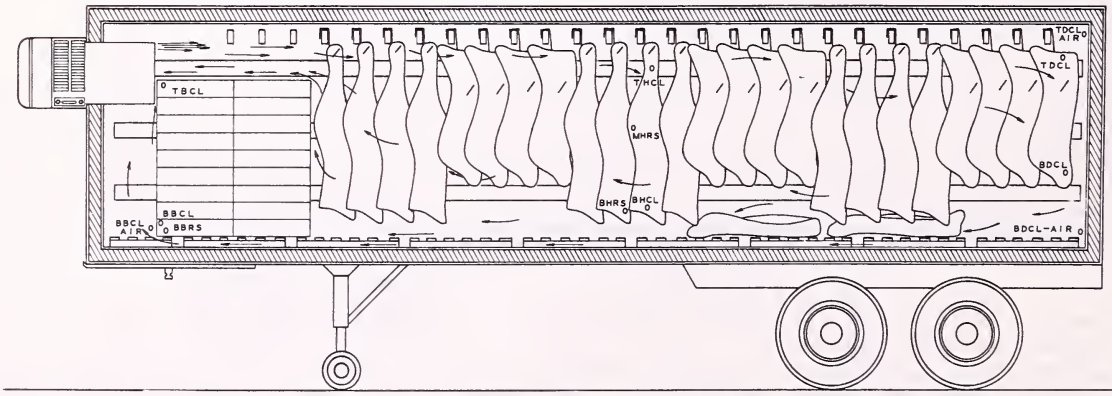


Figure 4.--A diagram showing a mixed load of boxed and hanging beef. The locations of the electrical resistance thermometers are also illustrated. For explanation of TBCL, THCL, etc., see page 2.

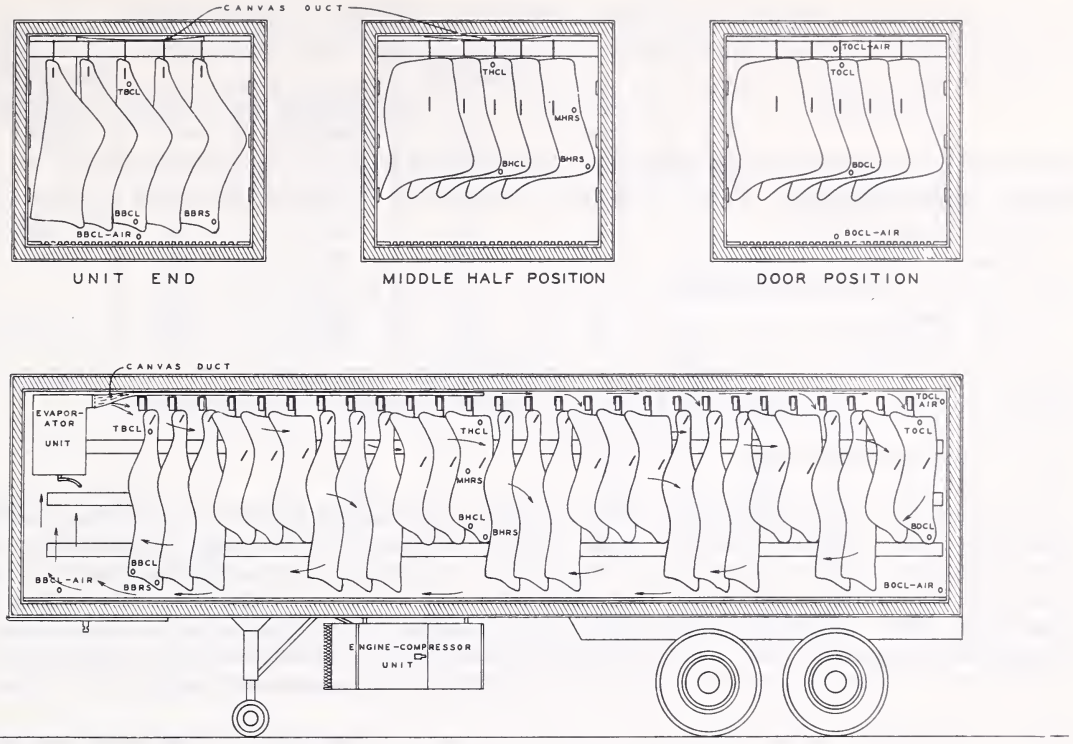


Figure 5.--A diagram showing a load of hanging beef. The canvas air duct and locations of the electrical resistance thermometers are also illustrated. For explanation of TBCL, THCL, etc., see page 2.

All of the test shipments contained low-grade beef (canner and cutter grade) destined for processing immediately upon arrival at destination. For this reason, the load patterns described and procedures followed during the tests are not typical of the standard practices used in the shipment of high-quality beef.

Transit Test No. I

In the first test, 2 refrigerated truck trailers equipped with heavy oak crossbeam meat rails were used. The mechanical refrigerating unit was located high in the front end of trailer A (fig. 4). Trailer B was equipped with the type built under the body of the trailer (fig. 5). Each of the units had a rated refrigeration capacity of approximately 5 tons. Trailer B was equipped with the experimental canvas air duct, previously described, to direct the cold air over the meat rails, allowing it to be dispersed the full length of the trailer (fig. 5).

Trailer A was loaded at Mount Pleasant, Tex., on May 15, 1953, with 75 boxes of boned bull meat on the floor and 125 quarters of beef suspended from the meat rails (fig. 4). The companion trailer B was loaded at Fort Worth, Tex., on the same day, with 150 quarters of hanging bull meat. After loading, both truck trailers returned to their terminal at Dallas, Tex., for final inspection. The next morning, both trucks left Dallas and traveled together as far as El Centro, Calif. Trailer A was destined to Los Angeles, and trailer B to San Diego.

Table 1 summarizes top and bottom load temperatures at origin after loading and at destination before unloading.

Table 1.--Transit test No. I, product temperatures

Location	Trailer A			Trailer B		
	Low	High	Average	Low	High	Average
Origin, after loading:	°F.	°F.	°F.	°F.	°F.	°F.
Top of load	42	46	44.0	38	48	42.3
Bottom of load	39	43	41.0	33	46	37.0
Destination, before unloading:						
Top of load	32	52	41.3	32	35	33.7
Bottom of load	34	40	37.0	30	35	32.4

Elapsed transit refrigeration time: A--69-5/6 hours; B--90-2/3 hours.

Outside temperature range: 44^0 to 76^0.

By grouping the destination temperatures of the top bunker centerline, bottom bunker centerline, and bottom bunker right side positions, an average temperature is obtained representative of the front of the load near the evaporator unit. Similarly, temperatures of the middle half right side, bottom half right side, top half centerline, and bottom half centerline give an average for the cargo midway between the evaporator and door. The average temperature for the load next to the door is obtained in the same way, using the temperature at the top door centerline and bottom door centerline.

Table 2.--Average temperature and maximum spread of destination temperatures within load areas using crossbeam meat rails

	Trailer A (No duct)	Trailer B (With canvas duct)
Trailer load area		
Front	°F.	°F.
Average	35.3	32.7
Spread	8.0	5.0
Center		
Average	37.3	34.0
Spread	2.0	6.0
Rear		
Average	52.0	34.5
Spread	-[1]	1.0

[1] Data not available.

Detailed temperature information is included in appendix tables 22 and 23 and figures 6 and 7.

Transit Test No. II

The second test was similar to the first in that the same type of equipment was used, both trailers having the wood crossbeam meat rails. Trailer C had a 5-ton mechanical refrigerating unit located high in the front end (fig. 4); trailer D had a unit of the same capacity built under the trailer body and was equipped with a canvas air duct (fig. 3). Quarters of beef usually are suspended from the meat rails as shown in figure 4; however, in trailer D the quarters were loaded on wood floor racks, graduated from 3 tiers high at the front end to 7 tiers high at the rear doors (fig. 3). This was an unusual method of loading and probably is used only for beef of canner and cutter grade.

Loading took place at Dallas, Tex., on May 15, 1953; trailer C was loaded with 240 quarters hanging from the meat rails, and trailer D with 260 quarters on the floor racks. After loading was completed, the refrigerating units were started and both trailers returned to their terminal for inspection. The following morning they departed for Detroit, Mich., traveling together the entire trip.

Tables 3 and 4 summarize top and bottom load temperatures at origin and at destination, and average temperatures and maximum spread of destination temperatures within trailer load areas.

Table 3.--Transit test No. II, product temperatures

Location	Trailer C			Trailer D		
	Low	High	Average	Low	High	Average
Origin, after loading:	°F.	°F.	°F.	°F.	°F.	°F.
Top of load	38	53	47.7	39	44	40.7
Bottom of load	42	52	47.2	34	44	40.5
Destination, before unloading:						
Top of load	36	48	40.3	29	37	33.0
Bottom of load	33	46	38.4	30	40	34.8

Elapsed transit refrigeration time: 63 1/2 hours.

Outside temperature range: 42° to 77°.

Table 4.--Average temperature and maximum spread of destination temperatures within load areas using crossbeam meat rails

	Trailer C (No duct)	Trailer D (With canvas duct)
Trailer load area		
Front	°F.	°F.
Average	34.3	34.3
Spread	3.0	10.0
Center		
Average	42.3	35.0
Spread	15.0	6.0
Rear		
Average	47.0	33.0
Spread	2.0	8.0

Detailed temperature information is included in appendix tables 24 and 25 and in figures 8 and 9.

Transit Test No. III

The third test provided performance data on trailer E, equipped with a refrigeration unit of an approximate 2-ton rated capacity and with longitudinal metal meat rails constructed of 2-inch aluminum pipe extending the full inside length of the trailer (fig. 2). A second trailer, F, was equipped with a 5-ton unit and wood crossbeams without canvas duct (fig. 1). The trailer bodies were of similar construction and the mechanical refrigeration units were made by the same manufacturer.

On May 23, 1953, at San Antonio, Tex., each trailer was loaded with 240 quarters of beef of canner and cutter grade, hung from the meat rails, and the trailers traveled together to St. Louis, Mo.

Tables 5 and 6 summarize top and bottom load temperatures at origin and at destination and average temperatures and maximum range of destination temperatures within trailer load areas.

Table 5.--Transit test No. III, product temperatures

Location	Trailer E			Trailer F		
	Low	High	Average	Low	High	Average
Origin, after loading:	°F.	°F.	°F.	°F.	°F.	°F.
Top of load	41	53	48.7	36	55	46.0
Bottom of load	34	42	39.0	40	54	45.0
Destination, before unloading:						
Top of load	43	49	45.3	34	61	45.7
Bottom of load	41	47	43.6	31	45	38.8

Elapsed transit refrigeration time: E--47-1/3 hours; F--44 hours.

Outside temperature range: 74° to 97°.

Table 6.--Average temperature and maximum spread of destination temperatures within load areas

	Trailer E (With longitudinal metal meat rails)	Trailer F (With crossbeam meat rails)
Trailer load area	°F.	°F.
Front		
Average	47.0	39.3
Spread	4.0	14.0
Center		
Average	44.3	35.5
Spread	9.0	8.0
Rear		
Average	43.0	52.0
Spread	2.0	18.0

Detailed temperature information may be found in appendix tables 26 and 27 and figures 10 and 11.

Transit Test No. IV

In test No. IV, trailer G was equipped with a mechanical refrigerating unit of 5-ton rated capacity, and trailer H had a refrigeration unit of approximately 2-ton capacity; both trailers were equipped with the wood crossbeam meat rails, without canvas air ducts (fig. 1). Each trailer was of the same type and construction as used in the previous tests. Because of inadequate supply in Dallas, Tex., it was impossible to load the 2 truck trailers with hanging beef on the same day. Loading of 250 quarters of beef on the meat rails was completed in trailer G on May 22, 1953, and in trailer H early on the morning of May 23, 1953. At 2:30 p.m. on the afternoon of May 23, both trailers departed from Dallas and traveled together to Chicago, Ill.

Tables 7 and 8 summarize load temperatures at origin and at destination and average temperatures and maximum range of destination temperatures within trailer load areas.

Table 7.--Transit test No. IV, product temperatures

Location	Trailer G			Trailer H		
	Low	High	Average	Low	High	Average
Origin, after loading:	°F.	°F.	°F.	°F.	°F.	°F.
Top of load	44	50	46.3	43	46	44.3
Bottom of load	44	53	46.8	40	42	41.2
Destination, before unloading:						
Top of load	39	52	45.3	36	45	40.0
Bottom of load	40	52	43.4	31	46	37.2

Elapsed transit refrigeration time: G--66-1/2 hours; H--53-1/2 hours.

Outside temperature range: 75° to 93°.

Table 8.--Average temperature and maximum spread of destination temperatures within load areas using crossbeam meat rails, without canvas ducts

	Trailer G (5-ton unit)	Trailer H (2-ton unit)
Trailer load area	°F.	°F.
Front		
Average	40.7	34.3
Spread	4.0	5.0
Center		
Average	41.8	37.8
Spread	5.0	3.0
Rear		
Average	52.0	45.5
Spread	0.0	1.0

Detailed temperature information may be found in appendix tables 28 and 29 and figures 12 and 13.

Transit Test No. V

The 2 trailers selected for this test were similar in construction to those used in prior tests, and were equipped with mechanical 5-ton-capacity refrigerating units. The units were located high in the front ends of the trailers (fig. 4). Trailer I was equipped with the crossbeam meat rails without the canvas air duct and trailer J was equipped with the longitudinal rails extending the full inside length of the trailer (fig. 2).

Both trailers were loaded at San Antonio, Tex., on July 10, 1954. The loads consisted of 248 quarters of beef of canner and cutter grade hung from the meat rails. When loading was completed, the thermostats on the mechanical refrigerating units of each trailer were set at 20° in an attempt to lower temperatures more rapidly. Upon arrival at Dallas, Tex., at 12:05 a.m. on July 11, the thermostat in trailer I was set at 30° for the remainder of the trip. The thermostat in trailer J was also raised to 30° upon arrival at Denison, Tex., 55 minutes later. Trailer J was delayed at Denison owing to mechanical failure of

the tractor, and for this reason the 2 trailers did not travel together to Chicago. Trailer I arrived at Chicago at 4:30 a.m., July 12, 1954, and trailer J arrived at 5:45 a.m. on July 13, 1954.

Tables 9 and 10 summarize the data.

Table 9.--Transit test No. V, product temperatures

Location	Trailer I			Trailer J		
	Low	High	Average	Low	High	Average
Origin, after loading:	°F.	°F.	°F.	°F.	°F.	°F.
Top of load	37	42	39.0	53	54	53.5
Bottom of load	38	43	39.6	41	47	44.2
Destination, before unloading:						
Top of load	34	38	36.0	29	35	32.0
Bottom of load	35	39	36.6	28	33	30.2

Elapsed transit refrigeration time: I--48-1/2 hours; J--67-3/4 hours.

Outside temperature range: 69° to 108°.

Table 10.--Average temperature and maximum spread of destination temperatures within load areas

	Trailer I (With crossbeam meat rails, no canvas duct)	Trailer J (With longitudinal metal meat rails)
Trailer load area		
Front	°F.	°F.
Average	34.7	30.0
Spread	1.0	0.0
Center		
Average	37.5	29.3
Spread	1.0	2.0
Rear		
Average	37.5	34.0
Spread	3.0	2.0

Detailed information is included in appendix tables 30 and 31 and figures 14 and 15.

Transit Test No. VI

In test No. VI, the 2 trailers were of the same general construction as those used in the previous tests. Comparisons were made of the 2 types of meat rails, (1) wood crossbeams with the canvas air duct installed above the crossbeams in trailer K, and (2) the longitudinal metal meat rails in trailer L. The mechanical refrigerating unit in each trailer was of 5-ton capacity and installed under the body of the trailer (fig. 5).

Each trailer was loaded at Mount Pleasant, Tex., on July 17, 1954, with 248 quarters of hanging beef of canner and cutter grade. Loading of trailer K began at 6:45 a.m. and was completed at 7:55 a.m. The trailer proceeded to the truck terminal at Dallas, Tex.,

where it remained 10 hours before departure for Chicago, Ill. Loading of trailer L was started at 8:05 a.m. and was completed at 9:25 a.m. and the truck left immediately for Chicago. It encountered a delay of 5 hours and 55 minutes at Memphis, Tenn., caused by a mechanical failure on the tractor. Although the 2 trailers did not travel together, they did encounter relatively the same outside temperatures during the time in transit.

Tables 11 and 12 present applicable data.

Table 11.--Transit test No. VI, product temperatures

Location	Trailer K			Trailer L		
	Low	High	Average	Low	High	Average
Origin, after loading:	°F.	°F.	°F.	°F.	°F.	°F.
Top of load	47	56	51.3	46	49	47.3
Bottom of load	48	52	49.4	41	48	45.4
Destination, before unloading:						
Top of load	36	41	38.0	31	44	35.3
Bottom of load	37	40	38.6	31	41	34.2

Elapsed transit refrigeration time: K--49 hours; L--53 hours.

Outside temperature range: 74° to 108°.

Table 12.--Average temperature and maximum spread of destination temperatures within load areas

	Trailer K (With crossbeam meat rails and canvas duct)	Trailer L (With metal meat rails)
Trailer load area		
Front	°F.	°F.
Average	37.7	32.7
Spread	2.0	2.0
Center		
Average	40.3	33.8
Spread	2.0	7.0
Rear		
Average	37.0	42.5
Spread	2.0	3.0

Detailed information may be found in tables 32 and 33 and figures 16 and 17 in the appendix.

RESULTS

In order to present a condensed comparative picture of the results, the test trailers are grouped on the basis of similarities in equipment used and methods of handling.

Group No. 1 includes loads in trailers equipped with crossbeam meat rails (without canvas air ducts) and refrigeration units of approximately 5-ton capacity. These tests include trailers A, C, F, G, and I.

The following tables present average product temperatures at origin after loading and at destination before unloading, together with a computation showing the average in-transit product temperature change for group No. 1 trailers. Also shown are the average temperatures and maximum spreads of destination temperatures within load areas, and the before-unloading average product temperature range for group No. 1 trailers.

Table 13.--Product temperatures, group No. 1 trailers

Location	Low	High	Average
	°F.	°F.	°F.
Origin	38.6	50.6	44.2
Destination	33.8	51.2	40.5
Change			-3.7

The range in average product temperatures at destination was 17.4°.

An examination of table 28 covering trailer G reveals that at no time during the trip did the product or air temperature reach a level of 35.0° F. It appears that the refrigeration thermostat was not operating correctly. Therefore, statistics covering this load are eliminated from any further analysis of results. Also eliminated are temperature data covering trailer A (table 22). Here, the top door centerline position shows a rise of 10.0°. Evidence of road dust on the load indicated a sizable air leak in the rear trailer door. Too, this load included boxed and hanging beef, whereas other loads in group No. 1 consisted of all hanging beef. This may have had some influence on temperature readings.

Trailer loads C, F, and I are selected as representative for group No. 1 and tables 14 and 15 summarize the product temperatures for these trailers.

Table 14.--Product temperatures, trailers C, F, and I

Location	Low	High	Average
	°F.	°F.	°F.
Origin	37.0	51.3	44.2
Destination	32.7	50.7	39.2
Change			-5.0

The range in average product temperatures at destination was 18.0°.

Table 15.--Average temperatures and maximum spread of destination temperatures within load areas for trailers C, F, and I

Trailer load area	Average	Spread
	°F.	°F.
Front	36.1	6.0
Center	38.4	8.0
Rear	45.5	7.7

While from time to time individual within-load temperatures did drop to the thermostat control setting of 35.0°F. or lower, average product temperatures within trailer loads C and F were well above that level. The thermostat in trailer I at origin was set at 20.0° and after 26 hours in transit was adjusted upward to 30.0° (table 30). The notable result was that average product temperatures in trailer I approached 35.0°, and the maximum spread of temperatures within load areas was 1.0° at front and center and 3.0° at the rear, far below those for trailers C and F.

Average product temperatures in trailers C, F, and I declined only 5.0°F. between origin and destination and there was an 18.0° spread between the warmer and cooler cargo at destination. The evidence of inadequate cooling, particularly at the rear ends of the trailers, and the wide variations in load temperatures indicate that the crossbeam meat rails caused back pressures and retarded the circulation of air from the cooling units.

Trailers equipped with canvas air ducts extending from the front of the trailers toward the rear and above the crossbeam meat rails are in group No. 2. This group has refrigeration units of approximately 5-ton capacity and includes trailers B, D, and K.

The following tables present average product temperatures at origin after loading and at destination before unloading, together with the average temperatures and maximum temperature spreads at destination within load areas.

Table 16.--Product temperatures, group No. 2 trailers

Location	Low	High	Average
	°F.	°F.	°F.
Origin	38.0	48.7	47.2
Destination	31.7	38.7	36.2
Change			-11.0

The average range in product temperatures at destination was 7.0°.

Table 17.--Average temperatures and maximum range of destination temperatures within load areas for trailers B, D, and K

Trailer load area	Average	Spread
	°F.	°F.
Front	34.9	5.7
Center	36.4	4.7
Rear	34.8	3.7

Average product temperatures declined 11° F. between origin and destination and the range in average product temperatures at destination was 7.0°. Within load areas the average range of temperature was from 3.7° at the rear to 5.7° at the front, indicating that use of the canvas air duct over the crossbeam meat rails proved efficient in distributing the cold air and maintaining general uniformity in temperature throughout the load.

In trailer K, the thermostat setting at origin was 40.0°F. After 12 hours in transit, it was reset at 34.0°. Between origin and destination, average product temperatures were lowered 11.9° and the product temperature range at destination was 5.0°. The average spread of temperatures within load areas was 2.0°.

Trailer D was equipped with a temporary wood floor rack and the meat was placed on the rack tiered upward from front to rear. Notable was the fact that the average spread of temperature within the front area was 10.0°F., decreasing to 6.0° at center and 8.0° at the rear. Average temperatures were below 35.0° in all areas.

Group 3 includes trailers J and L, each equipped with a refrigeration unit of approximately 5-ton capacity. Both had longitudinal metal meat rails. They are analyzed separately because the thermostat settings varied. The setting on trailer J at origin was 20.0°F. and after 15 hours in transit it was raised to 30.0°F. Tables 18 and 19 summarize the product temperatures for this trailer.

Table 18.--Product temperatures, trailer J

Location	Low	High	Average
	°F.	°F.	°F.
Origin	41.0	54.0	46.4
Destination	28.0	35.0	30.6
Change			-15.8

The range in average product temperatures at destination was 7.0°F.

Table 19.--Average temperatures and maximum spread of destination temperatures within load areas, trailer J

Trailer load area	Average	Spread
	°F.	°F.
Front	30.0	(1)
Center	29.3	2.0
Rear	34.0	2.0

[1] Thermometer failed to register at top bunker centerline.

Upon completion of loading of trailer L, the thermostat was set at 40.0° F. and 7¼ hours later it was reset at 30.0°. Table 20 summarizes the product temperatures for this trailer.

Table 20.--Product temperatures, trailer L

Location	Low	High	Average
	°F.	°F.	°F.
Origin	41.0	49.0	46.3
Destination	31.0	44.0	35.3
Change			-11.0

The range in average product temperatures at destination was 13.0°F.

Table 21.--Average temperatures and maximum spread of destination temperatures within load areas, trailer L

Trailer load area	Average	Spread
	°F.	°F.
Front	32.7	2.0
Center	33.8	7.0
Rear	42.5	3.0

In trailers J and L, average product temperatures declined substantially during transit--15.8°F. for J and 11.0° for L. The spread between front, center, and rear temperatures in J was 4.7° and in L, 9.8°. Trailer E also was equipped with longitudinal metal meat rails, but had a refrigerating unit with capacity of only 2 tons. In this trailer the spread between average front, center, and rear temperatures was 4°. Considering together the 3 trailers with the longitudinal rails, the average spread between front, center, and rear temperatures was 6°, not as good as in the trailers fitted with the canvas ceiling ducts, but considerably better than in the trailers with the crossbeam wooden rails without ducts. A disadvantage of the trailers with wooden rails, either with or without ducts, is their weight, an important matter to the carrier. The weight of the heavy oak beams used in these trailers was estimated at 1,560 pounds, compared with 235 pounds for the aluminum rails.

Group 4 includes trailers E and H, each equipped with refrigeration units of approximately 2-ton capacity. Trailer E had the longitudinal metal meat rails and trailer H, the crossbeam meat rails only. While the range of average front, center, and rear temperatures in trailer E was excellent, apparently reflecting the use of the longitudinal meat rails, in-transit product temperatures in this trailer increased at most positions. In trailer H, while transit temperatures were reduced in the center and front positions, particularly the latter, rear temperatures rose. The resulting spread of 15° in temperatures in this load was unsatisfactory (tables 26 and 29). The evidence here is not sufficient to indicate the relative performance of the 2-ton units in contrast with those of 5 tons capacity.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

1. The wood crossbeam meat rails without a canvas air duct generally were unsatisfactory because of the wide range in the product temperatures upon arrival at destination. As shown in trailer C, the product temperatures averaged 40.6°F.; however, they ranged from 33.0° to 52.0°. In trailer F, the product temperatures at destination averaged 40.4°, and they ranged from 31.0° to 61.0°, a spread of 30 degrees.

2. The canvas air duct with the wood crossbeam rails greatly reduced the range of the product temperatures, as shown in trailer B. The temperatures ranged from 30.0°F. to 38.0°, and the load averaged 33.4°. In trailer D, the product temperatures averaged 34.3° and ranged from 29.0° to 40.0°. In trailer K, the average product temperature was 38.7°, and the range was from 36.0° to 41.0°.

3. Temperatures also were reduced substantially in the trailers equipped with the longitudinal aluminum meat rails. Although the spreads between front, center, and rear temperatures were not as good as in the trucks having the canvas ducts, they were better than in trucks without ducts and provided an important saving in weight.

In this series of tests, there was some lack of consistency in temperature results among trailers similarly equipped. For example, trailer I, with crossbeam wooden rails without ducts, had excellent temperatures, in contrast with the poor results in other trailers in the same group. While product temperatures were reduced satisfactorily in trailer L, with the longitudinal metal rails, the spread of almost 10° between front, cen-

ter, and rear temperatures was not compatible with that in the other trailers with the metal rails. Very probably these differences came about because of the variation in sizes and weights of carcasses in individual loads, and in the tightness with which they were compacted in loading. It has been mentioned that 3 or 4 quarters of small range beef cattle were hung from each hook in some instances, and it was observed that in some loads this appeared to interfere with proper air circulation. Loading fewer quarters in the trailer would probably improve this situation, but also would result in a smaller payload.

In transporting freshly killed beef over long distances, there are a number of important considerations that require special attention:

1. The mechanical refrigeration units should be checked and serviced after each trip to prevent mechanical failures while in transit to the greatest degree possible.

2. The thermostat on the mechanical refrigerating unit should be checked and calibrated frequently if the desired temperature is to be maintained.

3. During warm weather, the inside of the empty trailer should be well cooled before loading, to aid in maintaining the desired transit temperatures.

4. The crossbeam meat rails should not be used without some means of directing the cold air from the mechanical refrigerating unit over the rails to the rear of the trailer, such as the canvas duct used in these tests.

5. Door seals should be checked before loading, to prevent warm outside air from entering, because entrance of the air contributes to high product temperatures in the rear of the load.

6. For mutual protection of the shipper, carrier, and receiver, the driver, together with a representative of the shipper, should take and record representative product temperatures at the time of loading; and he should do so again with a representative of the receiver at the time of unloading. Temperature readings should be taken in carcasses at the front, middle, and rear of the trailer.

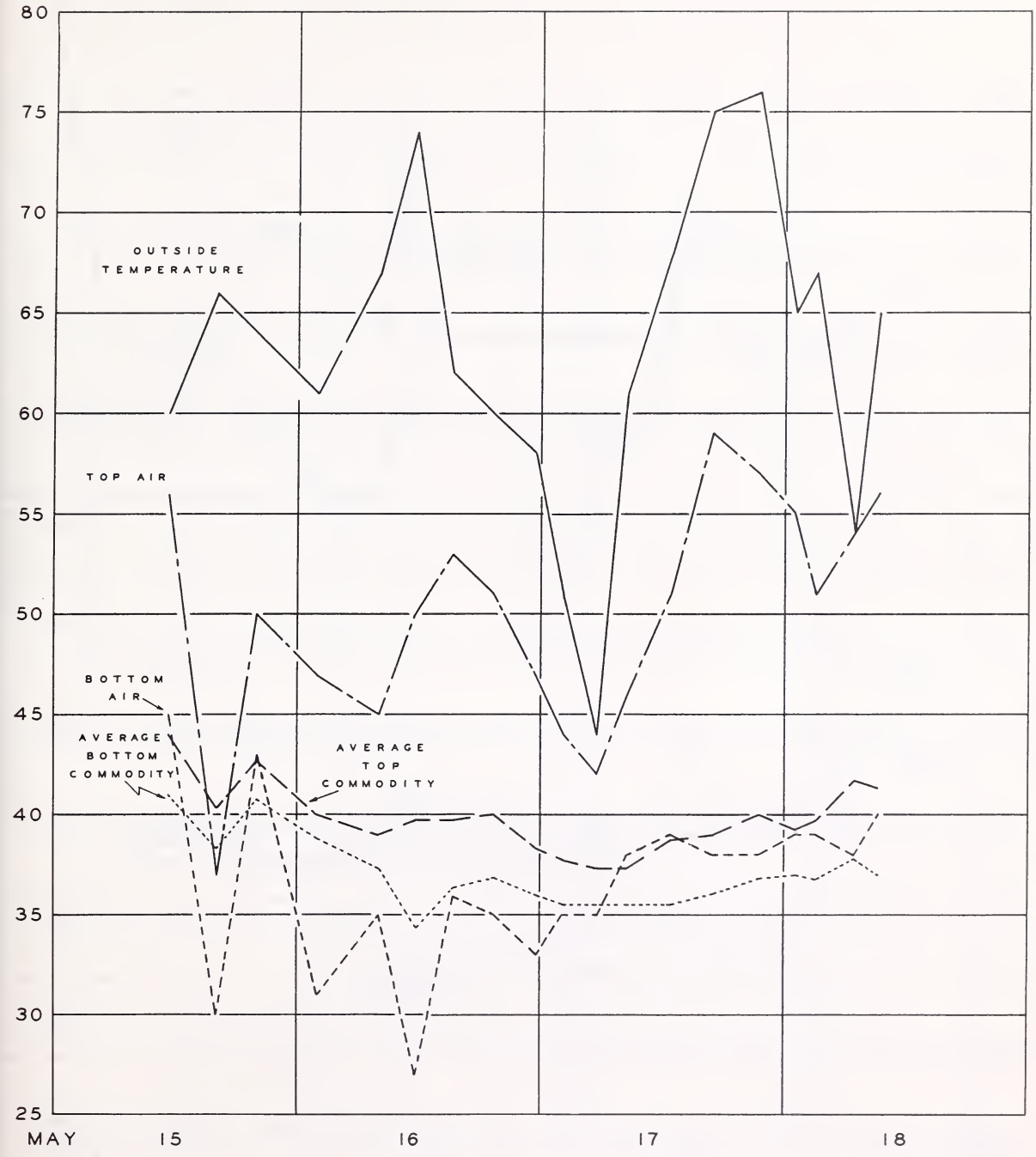


Figure 6.--Outside temperature and average temperatures of the top and bottom of the load during the time in transit in trailer A, test No. I.

Figure 7.--Outside temperature and average temperatures of the top and bottom of the load during the time in transit in trailer B, test No. I.

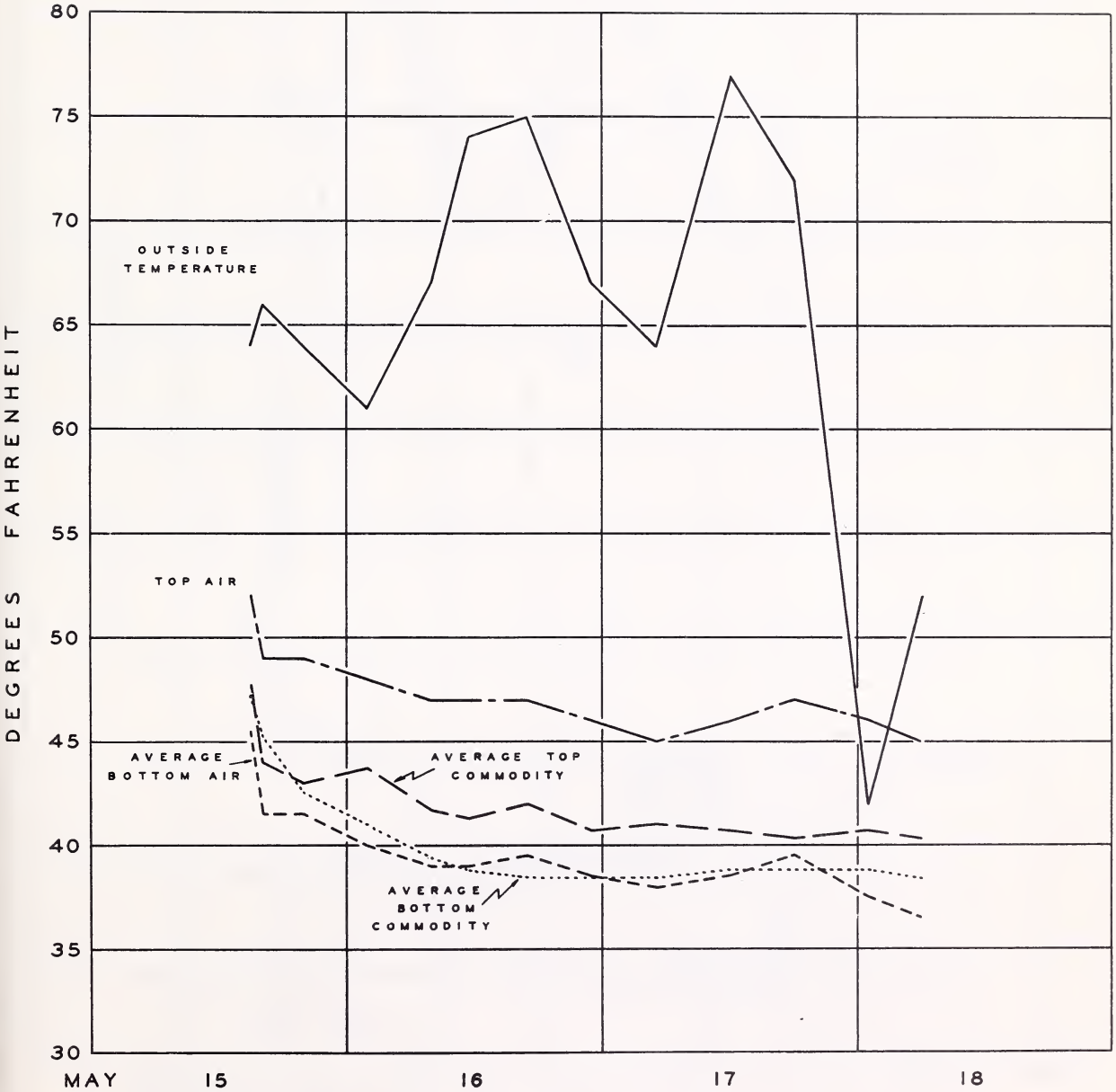


Figure 8.--Outside temperature and average temperatures of the top and bottom of the load during the time in transit in trailer C, test No. II.

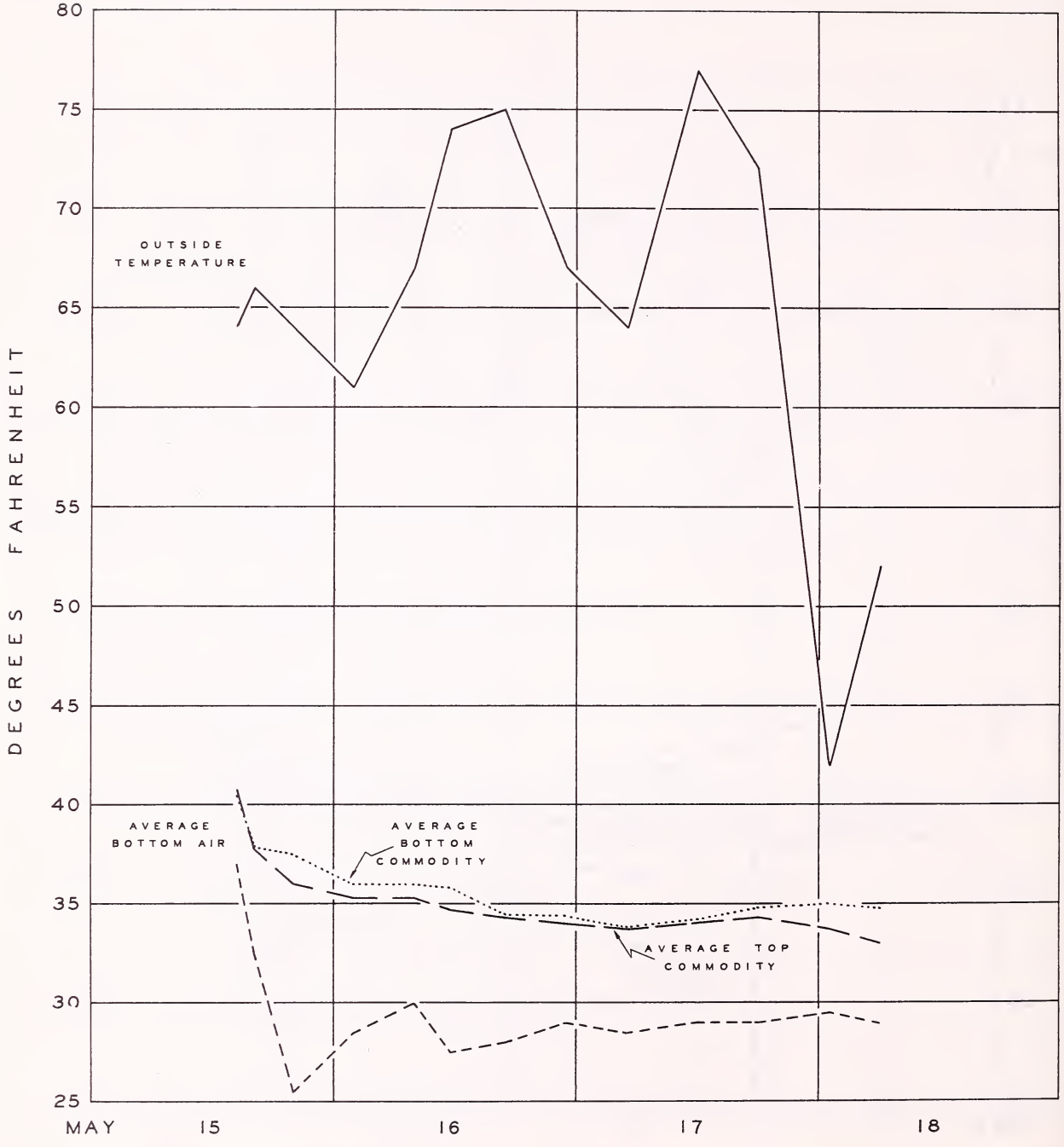


Figure 9.--Outside temperature and average temperatures of the top and bottom of the load during the time in transit in trailer D, test No. II.

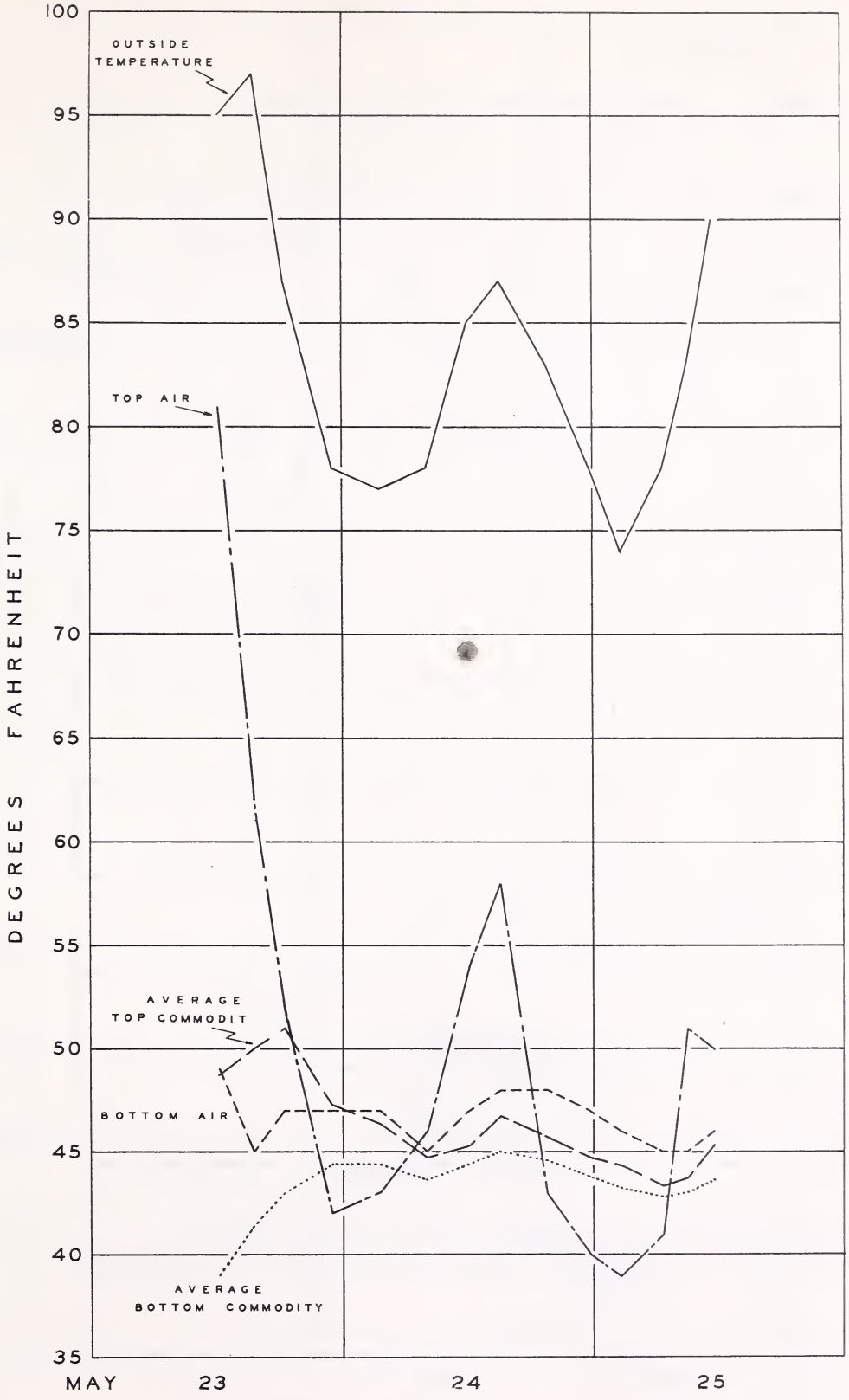


Figure 10.--Outside temperature and average temperatures of the top and bottom of the load during the time in transit in trailer E, test No. III.

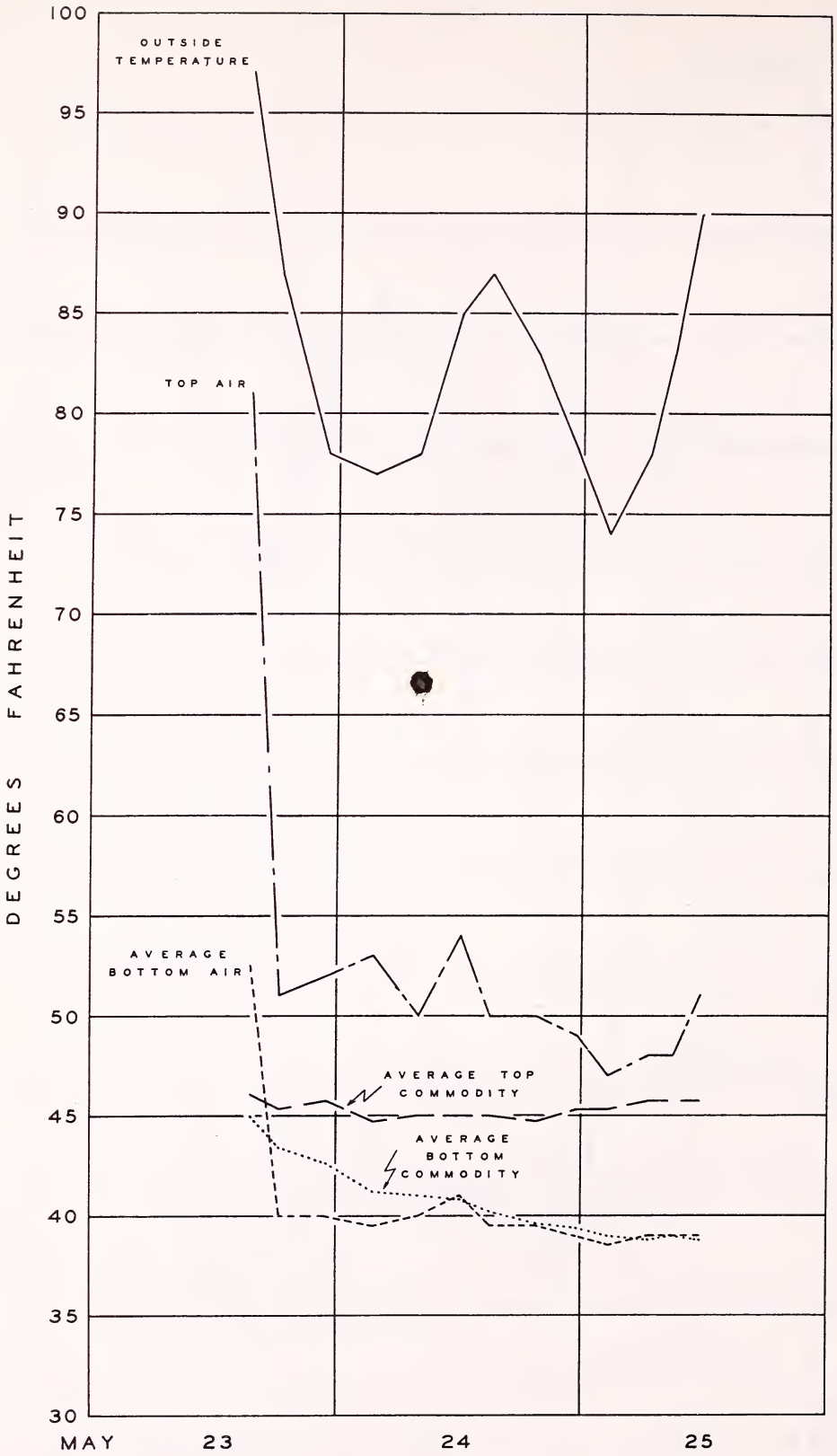


Figure 11.--Outside temperature and average temperatures of the top and bottom of the load during the time in transit in trailer F, test No. III.

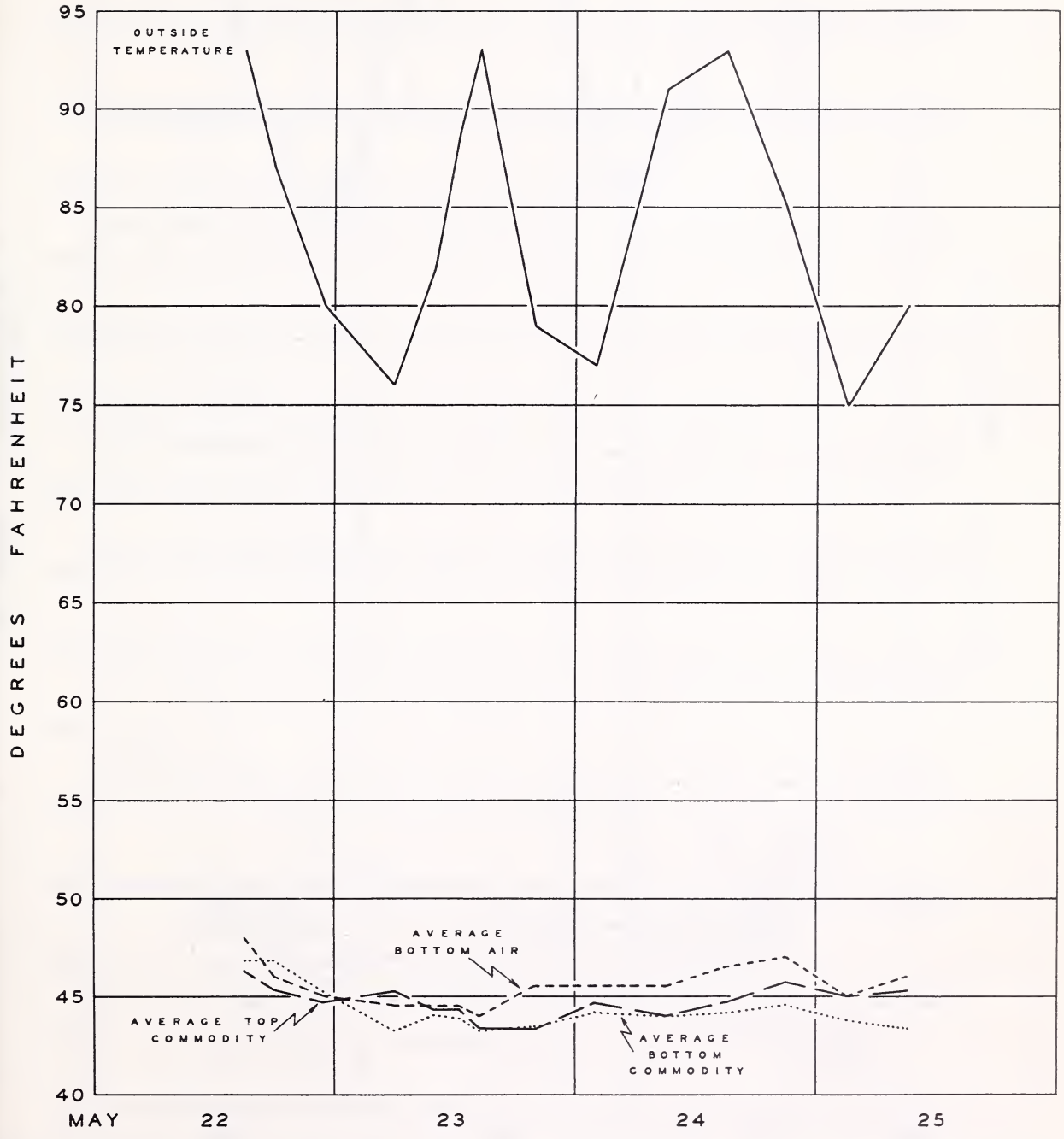


Figure 12.--Outside temperature and average temperatures of the top and bottom of the load during the time in transit in trailer G, test No. IV.

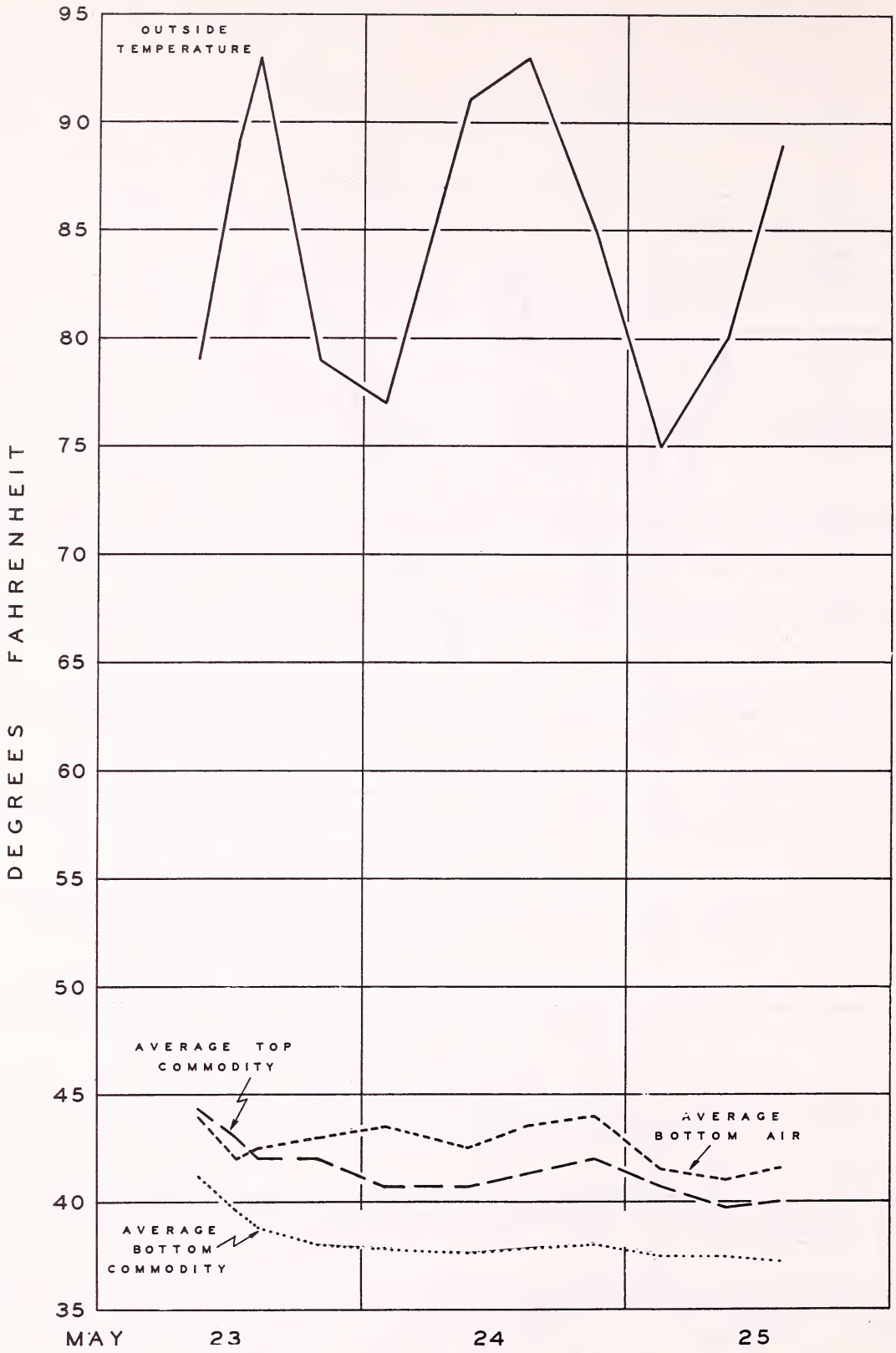


Figure 13.--Outside temperature and average temperatures of the top and bottom of the load during the time in transit in trailer H, test No. IV.

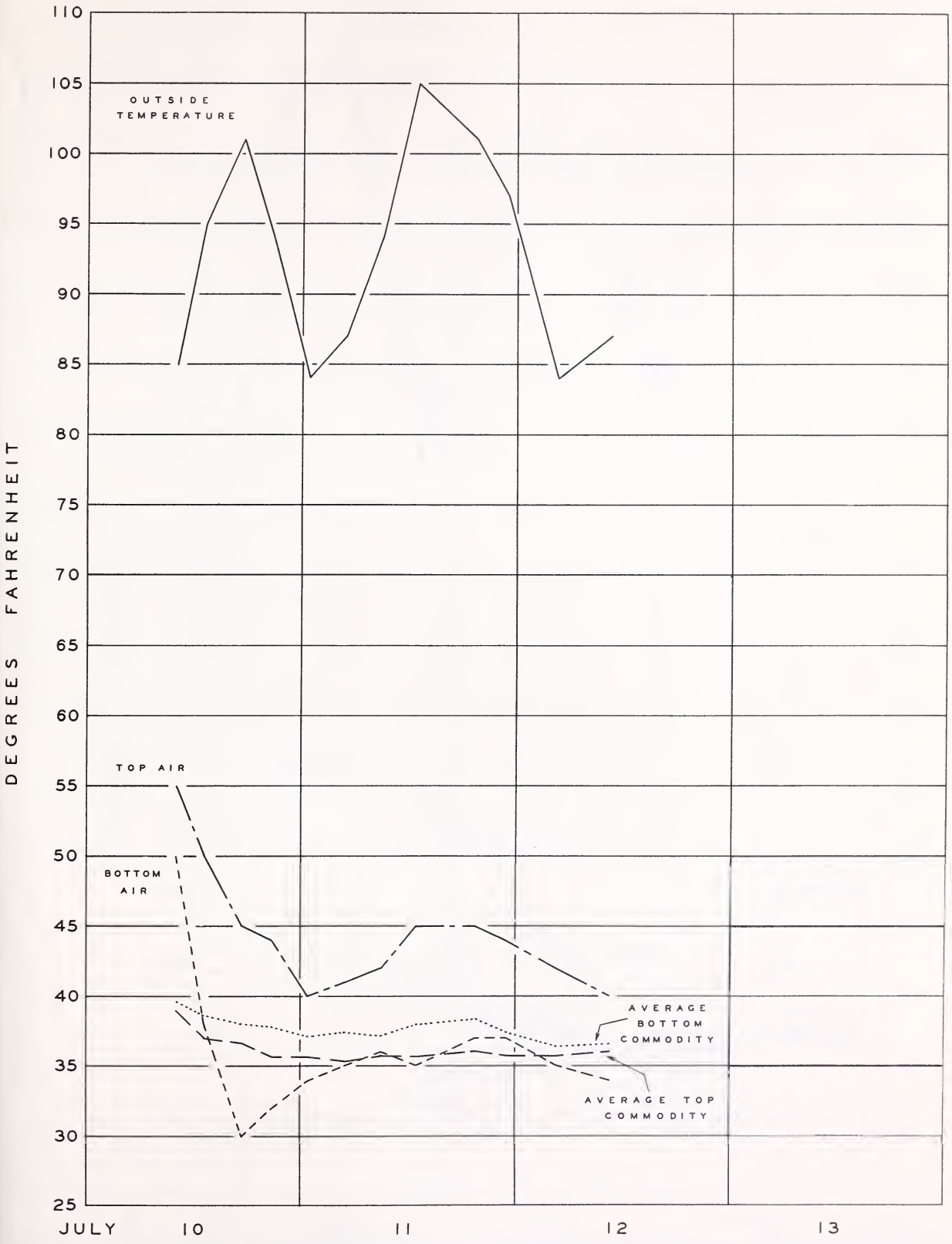


Figure 14.--Outside temperature and average temperatures of the top and bottom of the load during the time in transit in trailer I, test No. V.

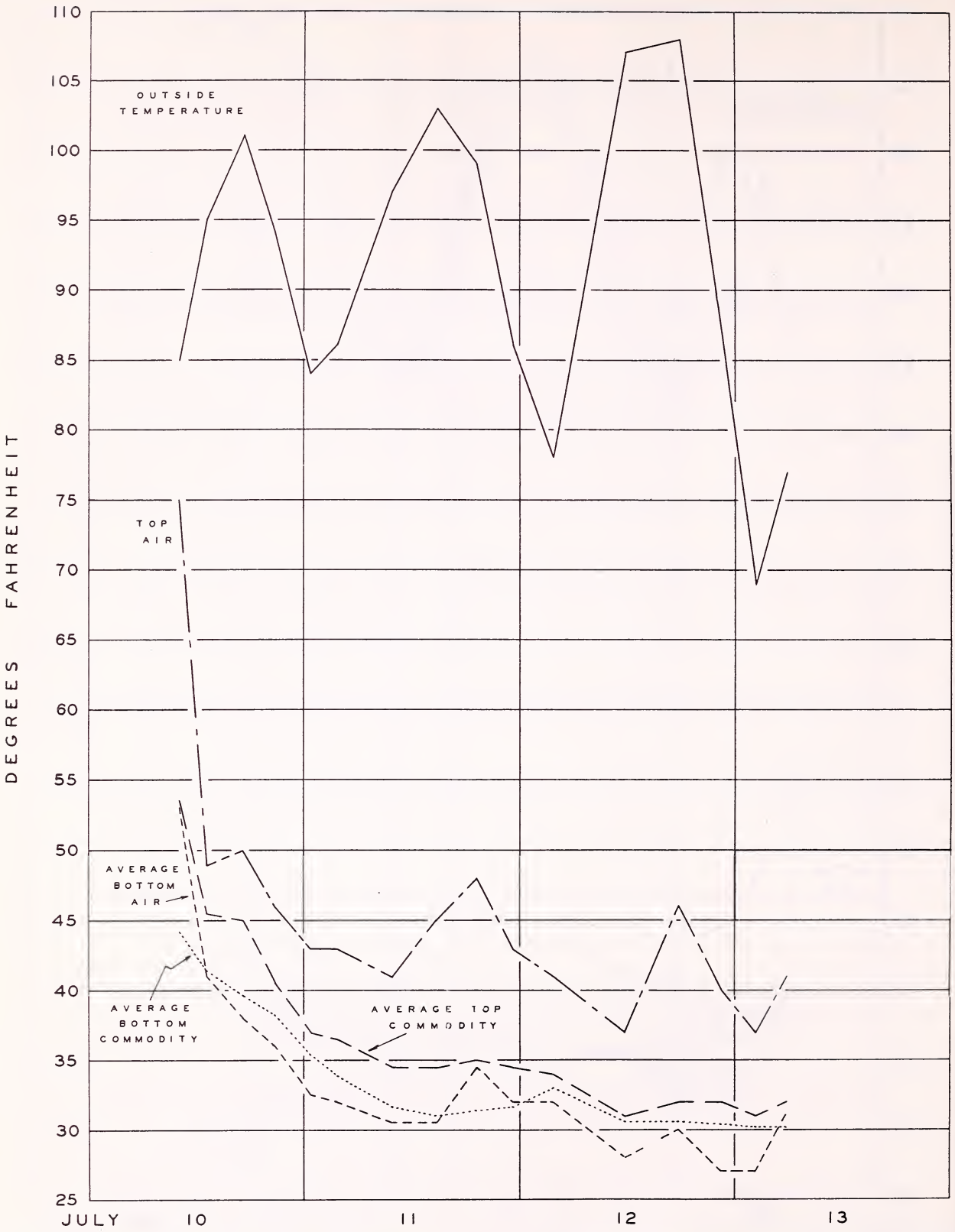


Figure 15.--Outside temperature and average temperatures of the top and bottom of the load during the time in transit in trailer J, test No. V.

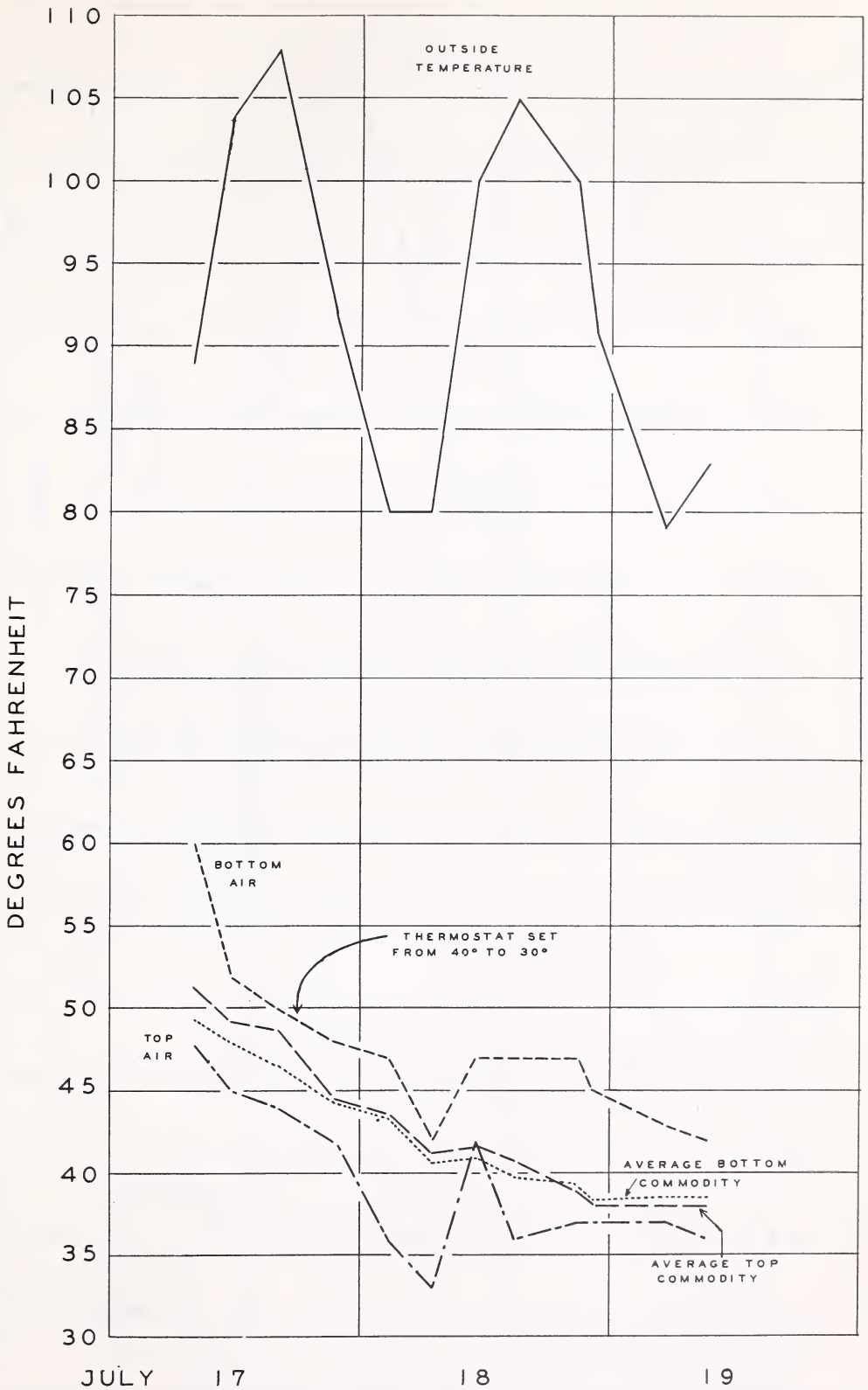


Figure 16.--Outside temperature and average temperatures of the top and bottom of the load during the time in transit in trailer K, test No. VI.

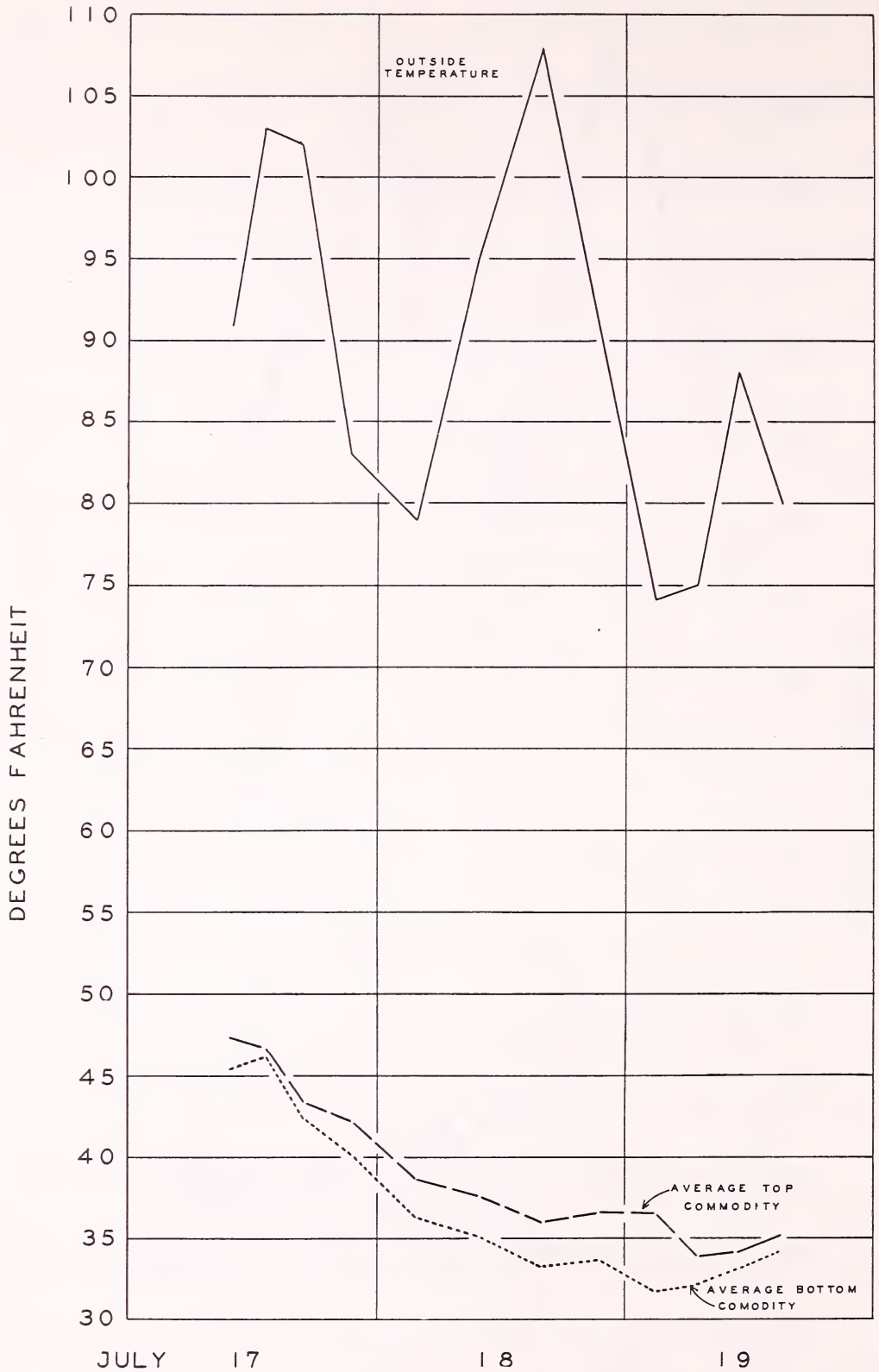


Figure 17.--Outside temperature and average temperatures of the top and bottom of the load during the time in transit in trailer L, test No. VI.

TABLE 22.--Temperatures recorded during transit test of boxed and hanging bull meat in trailer A, Mt. Pleasant, Tex., to Los Angeles, Calif. May 15 to May 18, 1953

Place	Date 1953	Time	Outside temp.	Air temperatures			Commodity temperatures								Top commodity			Bottom commodity		
				TDCL	BBCL	BDCL[1]	TBCL	THCL	TDCL	MHRS	BBCL	BBRS	BHCL	BHRS	BDCL[1]	Max.	Min.	Av.	Max.	Min.	Av.
			°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
Mt. Pleasant, Tex.	5-15	9:05 A	58	Trailer precooled to 35°F. Doors opened.																	
Mt. Pleasant, Tex.	5-15	9:25 A	58	Loading started																	
Mt. Pleasant, Tex.	5-15	11:12 A	60	Loading completed--doors closed																	
Mt. Pleasant, Tex.	5-15	11:15 A	60	Unit started--thermostat set at 35°F.																	
Mt. Pleasant, Tex.	5-15	11:20 A	60	56	45	--	42	46	42	38	39	41	43	41	--	46	42	44.0	43	39	41.0
Dallas, Tex.	5-15	4:00 P	66	37	30	--	37	41	43	38	38	34	40	41	--	43	37	40.3	41	34	38.3
Dallas, Tex.	5-15	8:00 P	64	50	43	--	40	43	45	40	40	42	41	40	--	45	40	42.7	42	40	40.8
Dallas, Tex.	5-16	2:00 A	61	47	31	--	36	41	43	38	38	41	38	38	--	43	36	40.0	41	38	38.8
Dallas, Tex.	5-16	8:00 A	67	45	35	--	35	40	42	37	36	40	37	36	--	42	35	39.0	40	36	37.3
Ft. Worth, Tex.	5-16	11:40 A	74	50	27	--	34	40	45	32	35	34	37	31	--	45	34	39.7	37	31	34.3
Seymour, Tex.	5-16	3:20 P	62	53	36	--	33	39	47	37	35	38	37	35	--	47	33	39.7	38	35	36.3
Lubbock, Tex.	5-16	7:20 P	60	51	35	--	33	40	47	37	35	39	37	36	--	47	33	40.0	39	35	36.8
Roswell, N. Mex.	5-16	11:30 P	57	47	33	--	32	39	44	36	34	39	36	35	--	44	32	38.3	39	34	36.0
Roswell, N. Mex.	5-17	2:15 A	51	44	35	--	32	38	43	36	34	38	35	35	--	43	32	37.7	38	34	35.5
Alamogordo, N. Mex.	5-17	5:30 A	44	42	35	--	33	37	42	36	34	38	35	35	--	42	33	37.3	38	34	35.5
Las Cruces, N. Mex.	5-17	8:30 A	61	46	38	--	33	37	42	36	33	38	36	35	--	42	33	37.3	38	33	35.5
Lordsburg, N. Mex.	5-17	12:45 P	68	51	39	--	33	39	44	36	33	38	36	35	--	44	33	38.7	38	33	35.5
Tucson, Ariz.	5-17	4:50 P	75	59	38	--	32	40	45	37	34	38	37	35	--	45	32	39.0	38	34	36.0
Gila Bend, Ariz.	5-17	9:25 P	76	57	38	--	30	40	50	37	34	40	37	36	--	50	30	40.0	40	34	36.8
Winter Haven, Calif.	5-18	1:00 A	65	55	39	--	32	40	46	37	35	40	37	36	--	46	32	39.3	40	35	37.0
Holtville, Calif.	5-18	3:00 A	67	51	39	--	33	40	46	37	34	40	37	36	--	46	33	39.7	40	34	36.8
Beaumont, Calif.	5-18	6:45 A	54	54	38	--	33	40	52	38	35	41	38	37	--	52	33	41.7	41	35	37.8
Los Angeles, Calif.	5-18	9:10 A	65	56	40	--	32	40	52	38	34	40	38	36	--	52	32	41.3	40	34	37.0
Los Angeles, Calif.	5-18	11:35 A	71	Doors opened																	
Los Angeles, Calif.	5-18	11:50 A	71	Unloading started																	
Los Angeles, Calif.	5-18	12:25 P	75	Unloading completed																	

[1] Thermometer at this position failed to register.

TABLE 23.--Temperatures recorded during transit test of hanging bull meat in trailer B, Ft. Worth, Tex., to San Diego, Calif. May 15 to May 19, 1953

Place	Date 1953	Time	Outside temp.	Air temperature			Commodity temperatures									Top commodity			Bottom commodity		
				TDCL	TBCL	BDCL	TBCL	THCL	TDCL	MHRS	BBCL	BBRS	BHCL	BHRS	BDCL	Max.	Min.	Av.	Max.	Min.	Av.
			°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
Ft. Worth, Tex.	5-15	9:15 A	52	Trailer precooled to 40°F--Doors opened																	
Ft. Worth, Tex.	5-15	9:15 A	52	Loading started																	
Ft. Worth, Tex.	5-15	12:30 P	57	Loading completed--doors closed																	
Ft. Worth, Tex.	5-15	12:40 P	57	Unit started--thermostat set at 35°F.																	
Ft. Worth, Tex.	5-15	12:45 P	57	55	24	54	41	38	48	43	35	36	35	33	46	48	38	42.3	46	33	37.0
Dallas, Tex.	5-15	4:00 P	66	38	19	41	37	34	40	42	33	35	34	33	39	40	34	37.0	39	33	34.8
Dallas, Tex.	5-15	8:00 P	64	36	26	40	38	34	39	42	33	35	35	33	38	39	34	37.0	38	33	34.8
Dallas, Tex.	5-16	2:00 A	61	34	24	38	36	33	38	42	32	36	34	34	35	38	33	35.7	36	32	34.2
Dallas, Tex.	5-16	8:00 A	67	35	18	38	35	31	35	42	31	32	32	32	34	35	31	33.7	34	31	32.2
Ft. Worth, Tex.	5-16	11:40 A	74	41	31	39	34	31	37	40	30	32	31	32	36	37	31	34.0	36	30	32.2
Seymour, Tex.	5-16	3:20 P	62	35	27	43	34	31	35	40	30	31	32	32	35	35	31	33.3	35	30	32.0
Lubbock, Tex.	5-16	7:20 P	60	35	21	43	34	31	34	40	30	32	32	32	34	34	31	33.0	34	30	32.0
Roswell, N. Mex.	5-16	11:30 P	57	34	27	38	34	30	34	39	30	31	32	32	33	34	30	32.7	33	30	31.6
Roswell, N. Mex.	5-17	2:15 A	51	33	20	37	34	31	34	39	30	31	32	32	33	34	31	33.0	33	30	31.6
Alamogordo, N. Mex.	5-17	5:30 A	44	33	23	38	34	31	33	39	30	32	32	32	33	34	31	32.7	33	30	31.8
Las Cruces, N. Mex.	5-17	8:30 A	61	33	17	(1)	34	31	34	38	30	31	32	32	33	34	31	33.0	33	30	31.6
Lordsburg, N. Mex.	5-17	12:45 P	68	35	17	--	34	31	35	37	30	31	32	32	34	35	31	33.3	34	30	31.8
Tucson, Ariz.	5-17	4:50 P	75	38	25	--	34	31	36	38	30	33	32	32	35	36	31	33.7	35	30	32.4
Gila Bend, Ariz.	5-17	9:25 P	76	36	26	--	34	31	36	38	30	32	32	32	36	36	31	33.7	36	30	32.4
Winter Haven, Calif.	5-18	1:00 A	65	35	23	--	33	30	35	38	30	31	33	32	35	35	30	32.7	35	30	32.2
Holtville, Calif.	5-18	3:00 A	67	34	27	--	33	30	35	38	30	31	33	32	35	35	30	32.7	35	30	32.2
San Diego, Calif.	5-18	8:20 A	69	32	22	--	34	30	33	38	30	31	32	31	33	34	30	32.3	33	30	31.4
San Diego, Calif.	5-18	12:30 P	72	32	23	--	34	30	34	39	30	31	33	32	33	34	30	32.7	33	30	31.8
San Diego, Calif.	5-18	4:30 P	71	32	22	--	34	30	34	37	30	31	33	31	33	34	30	32.7	33	30	31.6
San Diego, Calif.	5-18	5:45 P	67	34	20	--	34	32	35	37	30	32	33	32	35	35	32	33.7	35	30	32.4
San Diego, Calif.	5-19	7:00 A	58	34	23	--	35	32	34	38	30	33	32	32	35	35	32	33.7	35	30	32.4
San Diego, Calif.	5-19	7:10 A	58	Doors opened																	
San Diego, Calif.	5-19	7:15 A	58	Unloading started																	
San Diego, Calif.	5-19	8:05 A	58	Unloading completed																	

[1] Thermometer failed to register at this point.

TABLE 24.--Temperatures recorded during transit test of hanging beef quarters in trailer C, Dallas, Tex., to Detroit, Mich. May 15 to May 18, 1953

Place	Date 1953	Time	Outside temp.	Air temperatures			Commodity temperatures									Top commodity			Bottom commodity		
				TDCL	BBCL	BDCL	TBCL	THCL	TDCL	MHRS	BBCL	BBRS	BHCL	BHRS	BDCL	Max.	Min.	Av.	Max.	Min.	Av.
			°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
Dallas, Tex.	5-15	12:15 P	60	Trailer precooled to 44°F. Doors opened.																	
Dallas, Tex.	5-15	12:30 P	60	Loading started.																	
Dallas, Tex.	5-15	2:30 P	64	Loading completed - doors closed.																	
Dallas, Tex.	5-15	2:30 P	64	Unit started - thermostat set at 35°F.																	
Dallas, Tex.	5-15	3:00 P	64	52	41	50	38	53	52	56	42	45	49	48	52	53	38	47.7	52	42	47.2
Dallas, Tex.	5-15	4:10 P	66	49	35	48	31	49	52	54	41	42	45	47	51	52	31	44.0	51	41	45.2
Dallas, Tex.	5-15	8:00 P	64	49	36	47	31	46	52	52	38	39	42	--	51	52	31	43.0	51	38	42.5
Dallas, Tex.	5-16	2:00 A	61	48	35	45	33	45	53	52	35	38	41	41	50	53	33	43.7	50	35	41.0
Dallas, Tex.	5-16	8:00 A	67	47	34	44	33	41	51	50	34	36	39	40	48	51	33	41.7	48	34	39.4
Dallas, Tex.	5-16	11:30 A	74	47	34	44	33	40	51	48	34	35	38	39	48	51	33	41.3	48	34	38.8
Atoka, Okla.	5-16	5:00 P	75	47	34	45	33	42	51	48	33	34	38	40	47	51	33	42.0	47	33	38.4
Vinita, Okla.	5-16	11:00 P	67	46	33	44	34	38	50	49	34	34	39	39	46	50	34	40.7	46	34	38.4
Cuba, Mo.	5-17	5:00 A	64	45	33	43	35	38	50	50	34	34	39	39	46	50	35	41.0	46	34	38.4
Mt. Olive, Ill.	5-17	12:01 P	77	46	33	44	35	38	49	49	34	35	40	39	46	49	35	40.7	46	34	38.8
Gibson City, Ill.	5-17	6:00 P	72	47	34	45	35	37	49	51	34	35	40	39	46	49	35	40.3	46	34	38.8
Jonesville, Mich.	5-18	1:00 A	42	46	32	43	35	38	49	52	34	34	41	39	46	49	35	40.7	46	34	38.8
Detroit, Mich.	5-18	6:00 A	52	45	32	41	36	37	48	52	33	34	42	38	46	48	36	40.3	45	33	38.4
Detroit, Mich.	5-18	7:00 A	54	Doors opened.																	
Detroit, Mich.	5-18	7:05 A	54	Unloading started.																	
Detroit, Mich.	5-18	8:35 A	57	Unloading completed																	

TABLE 25.--Temperatures recorded during transit test of beef sides loaded on floor in trailer D, Dallas, Tex., to Detroit, Mich. May 15 to May 18, 1953

Place	Date 1953	Time	Outside temp.	Air temperatures			Commodity temperatures									Top commodity			Bottom commodity		
				TDCL[1]	BBCL	BDCL	TBCL	THCL	TDCL	MHRS	BBCL	BBRS	BHCL	BHRS	BDCL	Max.	Min.	Av.	Max.	Min.	Av.
				°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
Dallas, Tex.	5-15	12:01 P	63	Trailer precooled to 40°F. Doors opened.																	
Dallas, Tex.	5-15	12:15 P	63	Loading started.																	
Dallas, Tex.	5-15	2:20 P	64	Loading completed - doors closed.																	
Dallas, Tex.	5-15	2:20 P	64	Unit started - thermostat set at 35°F.																	
Dallas, Tex.	5-15	2:25 P	64	--	34	40	44	39	39	34	44	44	--	34	40	44	39	40.7	44	34	40.5
Dassas, Tex.	5-15	4:10 P	66	--	33	32	40	38	35	33	37	44	41	32	35	40	35	37.7	44	32	37.8
Dallas, Tex.	5-15	8:00 P	64	--	23	28	37	39	32	34	33	42	41	--	34	39	32	36.0	42	33	37.5
Dallas, Tex.	5-16	2:00 A	61	--	26	31	34	40	32	35	31	42	40	33	34	40	32	35.3	42	31	36.0
Dallas, Tex.	5-16	8:00 A	67	--	28	32	34	39	33	35	30	42	40	33	35	39	33	35.3	42	30	36.0
Dallas, Tex.	5-16	11:30 A	74	--	26	29	34	39	31	34	30	42	40	33	34	39	31	34.7	42	30	35.8
Atoka, Okla.	5-16	5:00 P	75	--	27	29	34	39	30	35	30	41	34	32	36	39	30	34.3	41	30	34.6
Vinita, Okla.	5-16	11:00 P	67	--	28	30	34	38	30	36	30	40	35	32	35	38	30	34.0	40	30	34.4
Cuba, Mo.	5-17	5:00 A	64	--	28	29	33	39	29	36	29	39	34	31	36	39	29	33.7	39	29	33.8
Mt. Olive, Ill.	5-17	12:01 P	77	--	29	29	34	39	29	36	29	39	35	32	36	39	29	34.0	39	29	34.2
Gibson City, Ill.	5-17	6:00 P	72	--	29	29	33	40	30	36	29	41	35	32	37	40	30	34.3	41	29	34.8
Jonesville, Mich.	5-18	1:00 A	42	--	29	30	33	38	30	37	30	40	36	32	37	38	30	33.7	40	30	35.0
Detroit, Mich.	5-18	6:00 A	52	--	29	29	33	37	29	36	30	40	36	31	37	37	29	33.0	40	30	34.8
Detroit, Mich.	5-18	9:00 A	57	Doors opened.																	
Detroit, Mich.	5-18	9:10 A	57	Unloading started.																	
Detroit, Mich.	5-18	11:30 A	64	Unloading completed.																	

[1] Temperature at this position failed to register.

TABLE 26.--Temperatures recorded during transit test of hanging beef quarters in trailer E, San Antonio, Tex., to St. Louis, Mo. May 23 to May 25, 1953

Place	Date 1953	Time	Out-side temp.	Air temperatures			Commodity temperatures									Top commodity			Bottom commodity		
				TDCL	BBCL	BDCL[1]	TBCL	THCL	TDCL	MHRS	BBCL	BBRS	BHCL	BHRS	BDCL	Max.	Min.	Av.	Max.	Min.	Av.
			°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
San Antonio, Tex.	5-23	9:10 A	82	Trailer precooled to 40°F. Doors Opened.																	
San Antonio, Tex.	5-23	9:10 A	82	Loading Started.																	
San Antonio, Tex.	5-23	11:15 A	95	Loading completed - doors closed.																	
San Antonio, Tex.	5-23	12:10 P	95	Unit started - thermostat set at 35°F.																	
San Antonio, Tex.	5-23	12:10 P	95	81	49	--	53	52	41	44	42	41	34	37	41	53	41	48.7	42	34	39.0
San Antonio, Tex.	5-23	3:30 P	97	62	45	--	54	50	46	47	44	45	38	40	40	54	46	50.0	45	38	41.4
New Braunfels, Tex.	5-23	6:20 P	87	52	47	--	54	50	49	49	46	46	39	43	41	54	49	51.0	46	39	43.0
Waco, Tex.	5-23	11:00 P	78	42	47	--	51	46	45	51	46	48	41	45	42	51	45	47.3	48	41	44.4
Dallas, Tex.	5-24	3:35 A	77	43	47	--	50	45	44	50	46	48	41	44	43	50	44	46.3	48	41	44.4
Atoka, Okla.	5-24	8:00 A	78	46	45	--	49	43	42	50	45	47	41	43	42	49	42	44.7	47	41	43.6
Muskogee, Okla.	5-24	12:01 P	85	54	47	--	49	44	43	50	45	48	42	45	42	49	43	45.3	48	42	44.4
Vinita, Okla.	5-24	3:00 P	87	58	48	--	50	45	45	50	47	48	42	45	43	50	45	46.7	48	42	45.0
Republic, Mo.	5-24	7:30 P	83	43	48	--	50	44	43	50	46	48	42	44	43	50	43	45.7	48	42	44.6
Waynesville, Mo.	5-24	11:40 P	78	40	47	--	49	43	42	50	45	48	42	42	42	49	42	44.7	48	42	43.8
Polla, Mo.	5-25	2:35 A	74	39	46	--	49	43	41	50	44	48	41	41	42	49	41	44.3	48	41	43.2
Kirkwood, Mo.	5-25	6:30 A	78	41	45	--	48	42	40	50	44	47	41	41	41	48	40	43.3	47	41	42.8
St. Louis, Mo.	5-25	8:50 A	83	51	45	--	48	42	41	50	43	47	41	43	41	48	41	43.7	47	41	43.0
St. Louis, Mo.	5-25	11:30 A	90	50	46	--	49	43	44	50	45	47	41	43	42	49	43	45.3	47	41	43.6
St. Louis, Mo.	5-25	3:00 P	91	Doors opened.																	
St. Louis, Mo.	5-25	3:00 P	91	Unloading started.																	
St. Louis, Mo.	5-25	3:55 P	93	Unloading completed.																	

[1] Thermometer at this position failed to register.

TABLE 27.--Temperatures recorded during transit test of hanging beef quarters in trailer F, San Antonio, Tex., to St. Louis, Mo. May 23 to May 25, 1953

Place	Date 1953	Time	Out-side temp.	Air temperatures			Commodity temperatures									Top commodity			Bottom commodity		
				TDCL	BBCL	BDCL	TBCL	THCL	TDCL	MHRS	BBCL	BBRS	BHCL	BHRS	BDCL	Max.	Min.	Av.	Max.	Min.	Av.
			°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
San Antonio, Tex.	5-23	12:25 P	95	Trailer precooled to 35°F. Doors opened.																	
San Antonio, Tex.	5-23	1:15 P	95	Loading started.																	
San Antonio, Tex.	5-23	3:20 P	97	Loading completed - doors closed.																	
San Antonio, Tex.	5-23	3:30 P	97	Unit started - thermostat set at 35°F.																	
San Antonio, Tex.	5-23	3:30 P	97	81	51	54	47	36	55	38	40	54	45	45	41	55	36	46.0	54	40	45.0
New Braunfels, Tex.	5-23	6:20 P	87	51	38	42	45	34	57	37	40	51	47	39	40	57	34	45.3	51	39	43.4
Waco, Tex.	5-23	11:00 P	78	52	37	43	44	34	59	36	37	47	47	41	41	59	34	45.7	47	37	42.6
Dallas, Tex.	5-24	3:35 A	77	53	36	43	42	32	60	35	35	47	47	35	42	60	32	44.7	47	35	41.2
Atoka, Okla.	5-24	8:00 A	78	50	37	43	42	34	59	35	35	46	42	39	43	59	34	45.0	46	35	41.0
Muskogee, Okla.	5-24	12:00 N	85	54	37	45	42	33	60	35	33	47	42	39	43	60	33	45.0	47	33	40.8
Vinita, Okla.	5-24	3:00 P	87	50	35	44	42	32	61	34	33	46	42	37	43	61	32	45.0	46	33	40.2
Republic, Mo.	5-24	7:30 P	83	50	35	44	41	31	62	34	32	45	41	37	43	62	31	44.7	45	32	39.6
Waynesville, Mo.	5-24	11:40 P	78	49	35	43	41	33	62	33	32	45	41	36	43	62	33	45.3	45	32	39.4
Rolla, Mo.	5-25	2:35 A	74	47	34	43	42	33	61	33	32	45	41	34	43	61	33	45.3	45	32	39.0
Kirkwood, Mo.	5-25	6:30 A	78	48	35	43	42	34	61	33	31	45	41	34	43	61	34	45.7	45	31	38.8
St. Louis, Mo.	5-25	8:50 A	83	48	35	43	42	34	61	33	32	45	41	34	43	61	34	45.7	45	32	39.0
St. Louis, Mo.	5-25	11:30 A	90	51	35	43	42	34	61	33	31	45	41	34	43	61	34	45.7	45	31	38.8
St. Louis, Mo.	5-25	3:20 P	92	Unit stopped - out of gas.																	
St. Louis, Mo.	5-25	4:05 P	93	Doors opened.																	
St. Louis, Mo.	5-25	4:15 P	93	Unloading started.																	
St. Louis, Mo.	5-25	5:40 P	94	Unloading completed.																	

TABLE 28.--Temperatures recorded during transit test of hanging beef quarters in trailer G, Dallas, Tex., to Chicago, Ill. May 22 to May 25, 1953

Place	Date 1953	Time	Out-side temp.	Air temperatures			Commodity temperatures									Top commodity			Bottom commodity		
				TDCL[1]	BBCL	BDCL	TBCL	THCL	TDCL	MHRS	BBCL	BBRS	BHCL	BHRS	BDCL	Max.	Min.	Av.	Max.	Min.	Av.
			°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
Dallas, Tex.	5-22	1:00 P	92	Trailer precooled to 66°F. Doors opened.																	
Dallas, Tex.	5-22	1:30 P	92	Loading started.																	
Dallas, Tex.	5-22	2:30 P	93	Loading completed - doors closed.																	
Dallas, Tex.	5-22	2:30 P	93	Unit started - thermostat set at 35°F.																	
Dallas, Tex.	5-22	3:00 P	93	--	45	51	45	44	50	47	46	47	44	44	53	50	44	46.3	53	44	46.8
Dallas, Tex.	5-22	6:00 P	87	--	43	49	44	41	51	47	47	46	44	45	52	51	41	45.3	52	44	46.8
Dallas, Tex.	5-22	11:00 P	80	--	41	49	41	43	50	46	45	43	43	45	50	50	41	44.7	50	43	45.2
Dallas, Tex.	5-23	6:00 A	76	--	41	48	44	42	50	42	45	40	42	41	48	50	42	45.3	48	40	43.2
Dallas, Tex.	5-23	10:00 A	82	--	41	48	42	41	50	43	45	42	42	43	48	50	41	44.3	48	42	44.0
Dallas, Tex.	5-23	12:30 P	89	--	41	48	42	41	50	43	45	41	42	43	48	50	41	44.3	48	41	43.8
Dallas, Tex.	5-23	2:30 P	93	--	40	48	41	39	50	43	44	40	42	42	48	50	39	43.3	48	40	43.2
Atoka, Okla.	5-23	8:00 P	79	--	40	51	40	40	50	42	44	40	43	42	48	50	40	43.3	48	40	43.4
Vinita, Okla.	5-24	2:00 A	77	--	40	51	42	41	51	42	45	41	45	41	49	51	42	44.7	49	41	44.2
Rolla, Mo.	5-24	9:00 A	91	--	41	50	39	42	51	41	44	41	44	41	50	51	39	44.0	50	41	44.0
St. Louis, Mo.	5-24	3:00 P	93	--	41	52	40	42	52	41	44	41	45	41	50	52	40	44.7	50	41	44.2
Springfield, Ill.	5-24	9:00 P	85	--	42	52	42	42	53	41	45	42	44	41	51	53	42	45.7	51	41	44.6
Chicago, Ill.	5-25	3:00 A	75	--	38	52	40	43	52	40	43	41	43	40	52	52	40	45.0	52	40	43.8
Chicago, Ill.	5-25	9:00 A	80	--	40	52	39	45	52	40	43	40	42	40	52	52	39	45.3	52	40	43.4
Chicago, Ill.	5-25	10:15 A	83	Doors opened.																	
Chicago, Ill.	5-25	10:30 A	83	Unloading started.																	
Chicago, Ill.	5-25	11:30 A	85	Unloading completed.																	

[1] Temperature at this position failed to register.

TABLE 29.--Temperatures recorded during transit test of hanging beef quarters in trailer H, Dallas, Tex., to Chicago, Ill. May 23 to May 25, 1953

Place	Date 1953	Time	Outside temp.	Air temperatures			Commodity temperatures									Top commodity			Bottom commodity		
				TDCL[1]	BBCL	BDCL	TBCL	THCL	TDCL	MHRS	BBCL	BBRS	BHCL	BHRS	BDCL	Max.	Min.	Av.	Max.	Min.	Av.
			°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
Dallas, Tex	5-23	7:00 A	77	Trailer precooled to 57°F. Doors opened.																	
Dallas, Tex	5-23	7:15 A	77	Loading started																	
Dallas, Tex	5-23	8:30 A	78	Loading completed--doors closed.																	
Dallas, Tex	5-23	8:30 A	78	Unit started--thermostat set at 35°F.																	
Dallas, Tex	5-23	9:00 A	79	--	43	45	46	44	43	43	40	42	40	42	42	46	43	44.3	42	40	41.2
Dallas, Tex	5-23	12:30 P	89	--	39	45	43	40	46	42	36	37	40	41	44	46	40	43.0	44	36	39.6
Dallas, Tex	5-23	2:30 P	93	--	40	45	40	40	46	41	35	36	39	40	44	46	40	42.0	44	35	38.8
Atoka, Okla	5-23	8:00 P	79	--	40	46	41	38	47	41	33	34	38	40	45	47	38	42.0	45	33	38.0
Vinita, Okla	5-24	2:00 A	77	--	40	47	36	38	48	41	33	34	38	38	46	48	36	40.7	46	33	37.8
Rolla, Mo	5-24	9:30 A	91	--	38	47	36	39	47	40	32	34	38	38	46	47	36	40.7	46	32	37.6
St. Louis, Mo	5-24	3:00 P	93	--	40	47	37	40	47	40	32	34	38	38	47	47	37	41.3	47	32	37.8
Springfield, Ill	5-24	9:00 P	85	--	40	48	38	40	48	40	32	34	39	38	47	48	38	42.0	47	32	38.0
Chicago, Ill	5-25	3:00 A	75	--	37	46	36	39	47	39	32	34	38	37	46	47	36	40.7	46	32	37.4
Chicago, Ill	5-25	9:00 A	80	--	37	45	35	39	45	38	31	36	38	36	46	45	35	39.7	46	31	37.4
Chicago, Ill	5-25	2:00 P	89	--	38	45	36	39	45	39	31	36	37	36	46	45	36	40.0	46	31	37.2
Chicago, Ill	5-25	2:50 P	91	Doors opened																	
Chicago, Ill	5-25	3:00 P	91	Unloading started																	
Chicago, Ill	5-25	6:00 P	92	Unloading completed																	

[1] Temperature at this position failed to register.

TABLE 30.--Temperatures recorded during transit test of hanging beef in trailer I, San Antonio, Tex., to Chicago, Ill., July 10-12, 1954

Place	Date 1954	Time	Outside temp.	Air temperatures			Commodity temperatures									Top commodity			Bottom commodity		
				TDCL	BBCL	BDCL	TBCL	THCL	TDCL	MHRS	BBCL	BBRS	BHCL	BHRS	BDCL	Max.	Min.	Av.	Max.	Min.	Av.
			°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
San Antonio, Tex.	7-10	--	--	Trailer precooled to 50°F. Doors opened.																	
San Antonio, Tex.	7-10	9:00 A	84	Loading started.																	
San Antonio, Tex.	7-10	10:00 A	85	Loading completed--doors closed.																	
San Antonio, Tex.	7-10	10:00 A	85	Unit started--thermostat set at 20°F.																	
San Antonio, Tex.	7-10	10:00 A	85	55	50	64	37	42	38	43	38	38	43	41	38	42	37	39.0	43	38	39.6
New Braunfels, Tex.	7-10	1:05 P	95	50	38	([1])	35	40	36	43	36	38	41	42	36	40	35	37.0	42	36	38.6
Waco, Tex.	7-10	5:20 P	101	45	30	--	34	40	36	42	35	37	40	42	36	40	34	36.7	42	35	38.0
Dallas, Tex.	7-10	8:45 P	94	44	32	--	33	39	35	42	35	37	40	41	36	39	33	35.7	41	35	37.8
Dallas, Tex.	7-11	12:05 A	--	Thermostat set at 30°F.																	
McKinney, Tex.	7-11	12:45 A	84	40	34	--	34	38	35	40	34	36	39	40	37	38	34	35.7	40	34	37.2
Vinita, Okla.	7-11	5:00 A	87	41	35	--	34	37	35	41	34	37	38	40	38	37	34	35.3	40	34	37.4
Republic, Mo.	7-11	9:00 A	94	42	36	--	33	37	37	40	33	36	38	41	38	37	33	35.7	41	33	37.2
Lebanon, Mo.	7-11	1:00 P	105	45	35	--	34	36	37	40	34	38	37	42	39	37	34	35.7	42	34	38.0
St. Louis, Mo.	7-11	7:30 P	101	45	37	--	35	37	36	39	34	38	37	42	41	37	35	36.0	42	34	38.4
Springfield, Ill.	7-11	11:00 P	97	44	37	--	35	37	35	39	35	37	36	40	39	37	35	35.7	40	35	37.4
Chicago, Ill.	7-12	4:30 A	84	42	35	--	34	38	35	38	35	36	35	38	38	38	34	35.7	38	35	36.4
Chicago, Ill.	7-12	10:30 A	87	40	34	--	34	38	36	38	35	35	37	37	39	38	34	36.0	39	35	36.6
Chicago, Ill.	7-12	10:30 A	87	Doors opened.																	
Chicago, Ill.	7-12	10:35 A	87	Unloading started.																	
Chicago, Ill.	7-12	11:10 A	88	Unloading completed.																	

[1] Thermometer failed to register at this point.

TABLE 31.--Temperatures recorded during transit test of hanging beef in trailer J, San Antonio, Tex., to Chicago, Ill., July 10-12, 1954

Place	Date 1954	Time	Outside temp.	Air temperatures			Commodity temperatures									Top commodity			Bottom commodity		
				TDCL	BBCL	BDCL	TBCL	THCL	TDCL	MHRS	BBCL	BBRS	BHCL	BHRS	BDCL	Max.	Min.	Av.	Max.	Min.	Av.
			°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
San Antonio, Tex.	7-10	8:40 A	--	Trailer precooled to 50°F. Doors opened.																	
San Antonio, Tex.	7-10	8:45 A	--	Loading started.																	
San Antonio, Tex.	7-10	10:00 A	--	Loading completed--doors closed.																	
San Antonio, Tex.	7-10	10:00 A	--	Unit started--thermostat set at 20°F.																	
San Antonio, Tex.	7-10	10:05 A	85	75	49	57	(1)	53	54	43	47	43	41	43	47	54	53	53.5	47	41	44.2
New Braunfels, Tex.	7-10	1:05 P	95	49	38	44	--	41	50	44	42	40	39	42	44	50	41	45.5	44	39	41.4
Waco, Tex.	7-10	5:20 P	101	50	33	43	--	40	50	42	38	39	37	41	43	50	40	45.0	43	37	39.6
Dallas, Tex.	7-10	8:45 P	94	46	33	39	--	33	48	41	36	38	35	39	43	48	33	40.5	43	35	38.2
McKinney, Tex.	7-11	12:45 A	84	43	28	37	--	29	45	38	33	36	32	36	40	45	29	37.0	40	32	35.4
Denison, Tex.	7-11	1:00 A	--	Thermostat set at 30°F.																	
Denison, Tex.	7-11	3:40 A	86	43	27	37	--	29	44	37	31	33	31	35	39	44	29	36.5	39	31	33.8
Denison, Tex.	7-11	9:45 A	97	41	26	35	--	28	41	33	30	31	29	32	36	41	28	34.5	36	29	31.6
Denison, Tex.	7-11	2:45 P	103	45	26	35	--	28	41	31	30	30	29	31	35	41	28	34.5	35	29	31.0
Checotah, Okla.	7-11	7:10 P	99	48	31	38	--	30	40	31	31	30	29	32	35	40	30	35.0	35	29	31.4
Seneca, Mo.	7-11	11:10 P	86	43	32	(1)	--	29	40	31	31	30	30	32	35	40	29	34.5	35	30	31.6
Republic, Mo.	7-12	3:45 A	78	41	32	--	--	29	39	31	31	36	30	33	35	39	29	34.0	35	30	33.0
Republic, Mo.	7-12	11:45 A	107	37	28	--	--	27	35	30	30	32	28	30	33	35	27	31.0	33	28	30.6
Sullivan, Mo.	7-12	5:35 P	108	46	30	--	--	28	36	30	30	31	28	31	33	36	28	32.0	33	28	30.6
Enroute, Ill.	7-12	10:25 P	87	40	27	--	--	28	36	30	30	30	28	31	33	36	28	32.0	33	28	30.4
Towanda, Ill.	7-13	2:20 A	69	37	27	--	--	21	35	30	30	30	28	30	33	35	27	31.0	33	28	30.2
Chicago, Ill.	7-13	5:45 A	77	41	31	--	--	29	35	30	30	30	28	30	33	35	29	32.0	33	28	30.2
Chicago, Ill.	7-13	10:10 A	85	Doors opened.																	
Chicago, Ill.	7-13	10:10 A	85	Unloading started.																	
Chicago, Ill.	7-13	10:50 A	87	Unloading completed.																	

[1] Thermometer failed to register at this point.

TABLE 32.--Temperatures recorded during transit test of hanging beef in trailer K, Mt. Pleasant, Tex., to Chicago, Ill., July 17-19, 1954

Place	Date 1954	Time	Outside temp.	Air temperatures			Commodity temperatures									Top commodity			Bottom commodity		
				TDCL	BBCL	BDCL	TBCL	THCL	TDCL	MHRS	BBCL	BBRS	BHCL	BHRS	BDCL	Max.	Min.	Av.	Max.	Min.	Av.
			°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
Mt. Pleasant, Tex.	7-17	--	--	Trailer precooled to 40°F. Doors opened.																	
Mt. Pleasant, Tex.	7-17	6:45 A	--	Loading started.																	
Mt. Pleasant, Tex.	7-17	7:55 A	--	Loading completed--doors closed.																	
Mt. Pleasant, Tex.	7-17	8:00 A	--	Unit started--thermostat set at 42°F.																	
Mt. Pleasant, Tex.	7-17	8:00 A	89	48	60	(1)	51	56	47	54	48	50	49	52	48	56	47	51.3	52	48	49.4
Dallas, Tex.	7-17	11:30 A	104	45	52	--	49	54	45	52	47	48	49	50	46	54	45	49.3	50	46	48.0
Dallas, Tex.	7-17	4:00 P	108	44	50	--	49	53	44	50	45	49	48	47	44	53	44	48.7	49	44	46.6
Dallas, Tex.	7-17	8:00 P	--	Thermostat set at 34°F.																	
Dallas, Tex.	7-17	9:30 P	92	42	48	--	44	49	41	49	42	49	45	45	42	49	41	44.7	49	42	44.6
Atoka, Okla.	7-18	2:30 A	80	36	47	--	42	49	40	47	41	46	44	44	42	49	40	43.7	46	41	43.4
Vinita, Okla.	7-18	6:30 A	80	33	42	--	40	46	38	44	40	38	42	42	41	46	38	41.3	42	38	40.6
Republic, Mo.	7-18	10:30 A	100	42	47	--	40	46	39	45	41	38	42	44	40	46	39	41.7	44	38	41.0
Lebanon, Mo.	7-18	2:00 P	105	36	47	--	39	43	37	42	39	38	40	41	41	43	37	39.7	41	38	39.8
St. Louis, Mo.	7-18	7:30 P	100	37	47	--	38	42	37	43	38	39	40	40	40	42	37	39.0	40	38	39.4
Springfield, Ill.	7-18	10:30 P	91	37	45	--	37	41	36	41	38	37	39	39	39	41	36	38.0	39	37	38.4
Chicago, Ill.	7-19	5:00 A	79	37	43	--	37	41	36	42	39	37	39	40	38	41	36	38.0	40	37	38.6
Chicago, Ill.	7-19	9:00 A	83	36	42	--	37	41	36	41	39	37	39	40	38	41	36	38.0	40	37	38.6
Chicago, Ill.	7-19	9:30 A	84	Doors opened.																	
Chicago, Ill.	7-19	9:30 A	84	Unloading started.																	
Chicago, Ill.	7-19	11:30 A	87	Unloading completed.																	

[1] Thermometer failed to register at this point.

TABLE 33.--Temperatures recorded during transit test of hanging beef in trailer L, Mt. Pleasant, Tex., to Chicago, Ill., July 17-19, 1954

Place	Date 1954	Time	Outside temp.	Air temperatures			Commodity temperatures									Top commodity			Bottom commodity		
				TDCL	BBCL	BDCL	TBCL	THCL	TDCL	MHRS	BBCL	BBRS	BHCL	BHRS	BDCL	Max.	Min.	Av.	Max.	Min.	Av.
			°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
Mt. Pleasant, Tex.	7-17	--	--	Trailer precooled to 40°F. Doors opened.																	
Mt. Pleasant, Tex.	7-17	8:05 A	89	Loading started.																	
Mt. Pleasant, Tex.	7-17	9:25 A	91	Loading completed--doors closed.																	
Mt. Pleasant, Tex.	7-17	9:25 A	91	Unit started--thermostat set at 40°F.																	
Mt. Pleasant, Tex.	7-17	9:35 A	91	(1)	(1)	64	46	47	49	48	41	46	48	45	47	49	46	47.3	48	41	45.4
Hope, Ark.	7-17	12:55 P	103	--	--	51	43	44	53	59	45	44	44	47	51	53	43	46.7	51	44	46.2
Little Rock, Ark.	7-17	4:45 P	102	--	--	47	39	40	51	48	37	40	39	45	51	51	39	43.3	51	37	42.4
Little Rock, Ark.	7-17	4:45 P	102	Thermostat set at 30°F.																	
Memphis, Tenn.	7-17	9:45 P	83	--	--	45	37	37	53	46	36	38	36	42	49	53	37	42.3	49	36	40.2
Memphis, Tenn.	7-18	3:40 A	79	--	--	39	32	33	51	43	33	33	33	38	45	51	32	38.7	45	33	36.4
Memphis, Tenn.	7-18	9:30 A	95	--	--	39	32	31	50	41	32	34	31	36	43	50	31	37.7	43	31	35.2
Blytheville, Ark.	7-18	3:20 P	108	--	--	38	31	28	49	40	29	31	30	35	42	49	28	36.0	42	29	33.4
Pinckneyville, Ill.	7-18	9:40 P	91	--	--	37	32	29	49	40	29	32	30	36	42	49	29	36.7	42	29	33.8
Lincoln, Ill.	7-19	2:35 A	74	--	--	35	35	28	47	39	26	31	28	34	40	47	28	36.7	40	26	31.8
Lemont, Ill.	7-19	6:30 A	75	--	--	37	30	27	45	38	27	32	29	34	39	45	27	34.0	39	27	32.2
Lemont, Ill.	7-19	10:30 A	88	--	--	37	30	28	45	37	28	36	30	33	39	45	28	34.3	39	28	33.2
Chicago, Ill.	7-19	2:30 P	80	--	--	38	34	31	44	38	32	32	31	35	41	44	31	35.3	41	31	34.2
Chicago, Ill.	7-19	4:10 P	81	Doors opened.																	
Chicago, Ill.	7-19	4:15 P	81	Unloading started.																	
Chicago, Ill.	7-19	5:20 P	82	Unloading completed																	

[1] Thermostat failed to register properly at this point.

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